WORLD PETROLEUM

NOVEMBER, 1959

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Automated Maracaibo Production Platform — Pg. 58

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Industrial Alcohols Plant slated for Continental Oil Company

ALFOL facility to be Constructed at Lake Charles, Louisiana, Will be Completed Early in 1961

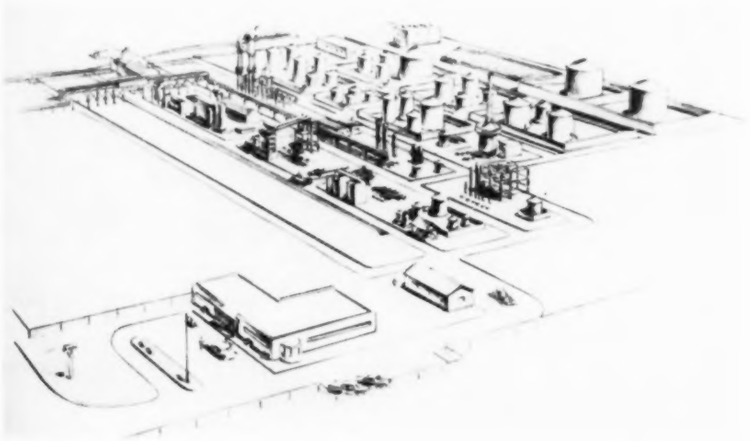
Continental Oil Company has announced that The Lummus Company has been awarded the contract to engineer and construct an Industrial Alcohols Plant at Lake Charles, Louisiana with a capacity of more than 50,000,000 lbs/yr.

These higher alcohols will be manufactured by a new technique originally conceived by Dr. Karl Ziegler. Organo-metallic catalysts are used to promote chain growth of ethylene followed by oxidation and hydrolysis to primary straight-chain alcohols containing an even number of carbon atoms.

With completion of the plant these fatty alcohols will be available for the first time from petroleum rather than the natural sources such as tallow fat and coconut oil from which they are now produced. These primary alcohols to be marketed under the Conoco trade name of "ALFOL", will be used in the manufacture of detergents, plastics, cosmetics, lubricating oil additives, paper, textiles and emulsifiers.

The primary raw material, ethylene, for these new products will be obtained from the ethylene plant operated at Lake Charles by Petroleum Chemicals, Inc. of which Conoco owns a 50% interest. This plant was also engineered and constructed by Lummus.

In the past 50 years, Lummus has built over 800 plants to produce petrochemicals, chemicals and petroleum products. If your company is planning facilities of this kind, discuss your plans with Lummus.



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World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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THIS MONTH'S COVER

J. Ray McDermott & Co., Inc. of New Orleans recently completed this complex electronically automated production flow station and installed it 35 miles offshore in Lake Maracaibo for Venezuelan Sun Oil Co. and its associates, Atlantic Refining Co. and Sinclair Oil & Gas Co. The platform gathers, separates, and pumps to shore the crude from 48 wells. A complete description of the installation by Stephen S. Roszel, Jr. is in this issue. Robert Yarnall Richie was the photographer for McDermott who pictured the platform with its maze of color-coded lines. Color plates are reproduced through the courtesy of J. Ray McDermott & Co., Inc.

Washington Pipeline

by Joseph B. Huttlinger

Oil Import Program Smooth

The oil import control program is settling into a pattern. U. S. officials are so pleased with the working of the system that they plan only a few changes in the next round starting Jan. 1, 1960.

One change under study is to allow newcomers to bring in oil products. This is in line with aims of the program. At present, only those who brought in products in 1957 are given product quotas today.

Another change might affect Puerto Rico. Officials are studying levying quotas on imports of crude and products from the island to the U. S. A. mainland. As it stands, crude and products into Puerto Rico are under quota, but there is free movement from the island to the mainland. Puerto Rican officials want the change.

The sliding scale, which gives smaller refiners a larger percentage of their refinery runs in imports than larger plants, may be changed to close the gap. But the graduated scale is to remain.

Residual fuel oil imports will be adjusted to the facts on demand in the U. S. A., but there is nothing in sight to indicate lifting of controls over this heavy fuel.

Canadian and Mexican crude oil and products will continue exempt. Venezuela, which seeks a minimum quota for her oil in U. S. markets, is doomed for disappointment. Officials are adamant against this.

Down the road, the idea of an international oil compact is seen as a possibility, but it's years down the road, if it comes at all. Total levels of imports of crude oil, unfinished oils and oil products will remain pegged at the present relation to domestic production, or domestic demand.

American-flag tanker operators and seamen will get no place quickly in their drive to force half the oil imports to travel on U. S. A. flag tankers. Down the road, however, this effort could produce some results. The joint Committee for American-flag tankers is ready to spend $500,000 a year in a long range effort to persuade the administration or the Congress to write a 50% provision into the import program. First step was a petition to the Office of Civil and Defense Mobilization.

This outlook is based on the assumption that prices for crude oil and oil products will continue at roughly the present levels or only slightly higher. If they were to rise markedly, all bets are off as to the fate of the import program. Certainly, a marked price rise for fuel oil and gasoline would stimulate attacks on the program from consuming state politicians. Probably, a big price rise would prompt Congress to investigate oil, the import program and the price increase. Outcome could be a weakening, if not a wrecking of the entire import program.

Recently, oil prices have been depressed. In fact, a top Cabinet official frankly admits that he would defend a rise in oil prices to the levels they held two years ago and never reached since. He blames "excessive" refinery runs for the softness of product prices, but disapproves of government controls over the runs to handle the situation.

U. S. officials feel it may take a year or two to tell whether the import program is bringing the results hoped for, which, it is explained, includes a stepup in wildcat drilling. At the moment, however, they are generally pleased with the outcome. They point to the start of a pickup in rigs active, well completions and, even, in wildcat drilling.

Domestic producers, in general, are content with the program, although they find their production levels well below what they had expected them to be. Even international oil companies appear, in general, willing to accept the program, for there have been few determined challenges in the courts to the constitutionality of the program, as were widely expected at one time. The court attacks have been on narrower grounds.

Washington Views on Borden

U. S. government and oil industry officials took a dim view of the recommendations on crude oil of the Borden Commission in Canada. There were assertions that it appears "unsound," "impractical" and "unrealistic."

An official of an association of U. S. oil producers saw the plan as one to move Venezuelan and Middle Eastern crude oil, in effect, into the northwest of the U. S. This comes about, he said, if Western Canada's crude oil, instead of moving to Montreal, is sent to the U. S. and Venezuelan and Middle Eastern crude supplies Montreal refineries. He added that the report seems to recommend against interference with normal marketing of oil, but also urges great efforts to increase Canadian oil exports to the U. S., policies which he said seem contradictory.

Both industry and government officials took a dim view of the prospect of a major increase in Canada's crude oil exports to the U. S. actually being achieved in the next 12 to 18 months. Canada's exports of crude and unfinished oils reached about 112,000 b/d during July, and informed officials saw little chance of much increase. "Extraordinary efforts" and the "twisting of arms of some oil companies, will be needed to bring about a substantial increase from this level," one informed U. S. official commented.

Another U. S. official said the level of crude oil exports from Canada to the U. S. "depends upon price as much as on anything else." Oil and gas producers both in Canada and the U. S. object to a lowering of crude oil prices at the present time.

Some U. S. officials thought it "unrealistic" for Canada to seek both the benefits of lower cost foreign crude in her Eastern plants and the benefits of export markets for her crude oil in the West. "They seem to want to profit at both ends," an official explained.

Any major increase in Canadian crude oil to the U. S. would run smack against the U. S. oil imports program. This implies that the Canadian exemption is to be curbed if there is a dramatic increase in crude imports from Canada. Just how much Canadian imports could increase before there is a crackdown is to be determined. Official policy in the U. S. is that authorities are watching the Canadian imports.

In practice, however, the U. S. might find it hard to curb imports of crude from Canada now that the exemption has been given. The overall import program is to keep the U. S. oil industry strong in event of emergency; some argue that it is equally important to the U. S. to keep the Canadian oil industry strong in event of emergency.

The Borden Commission suggested that there are factions in the exemption of Canadian crude oil from the import program that tend to work against oil imports from Canada. Apparently, the commission referred to the fact that refinery runs based on Canadian crude oil do not count in determining the size of a refiner's crude oil import quota from other areas. So, a refiner wanting a larger import quota might be tempted to run less Canadian oil and more from other areas.

U. S. officials defend this policy on the grounds that (1) U. S. refiners in the Midwest could not use and thus do not need a quota to import crude from other areas; and (2) U. S. refiners in the Pacific Northwest, using Canadian crude oil, otherwise would receive import quotas for other areas at the expense of other West Coast refiners not able to use Canadian crude.

The idea of a continental oil policy, suggested by the Borden Commission, met a warmer reception. While U. S. officials agreed that there is nothing concrete along this line in the hopper, they thought the idea had merit. William R. Connole of the U. S. Federal Power Commission, who long has advocated a natural gas policy for all of North America, thought a continental oil policy "eminently sound." Mr. Connole has suggested that all reserves of natural gas in Canada, the U. S. and Mexico should be added up and measured against all demands from the overall area as a starting point in a gas policy. The same thing might be done for oil, he said. "A continental energy policy is wholly sound and is workable."

The Borden Commission suggested that the Canadian exemption from the U. S. oil imports program is a good starting point for a continental oil policy. It suggested study be given to broadening the exemption to cover tanker movement of oil from Canada and Mexico as well as overland movement, and ending the U. S. import tax of 10.5 cents a barrel on oil from this continent.

U. S. officials expressed agreement with the finding that government help of some sort would be needed for a crude oil pipeline from Western Canada to Montreal. They also agreed that a tariff on foreign oil imports would not be sufficient help, but that a license system for imports, to be given after plants have used their share of the pipeline crude from Western Canada, could work.

Some officials remarked cynically that the Borden Commission's first report suggested strict controls on natural gas exports to take care of Canada's needs first; but urged easing of export controls on crude oil, and more exports, since Caiada has plenty of oil in sight. Another U. S. official said more oil production would help bring more casing head gas output, and thus bolster supply for the Trans-Canada Pipe Lines Ltd.

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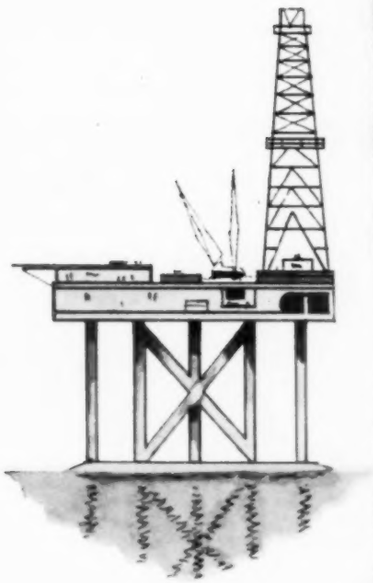

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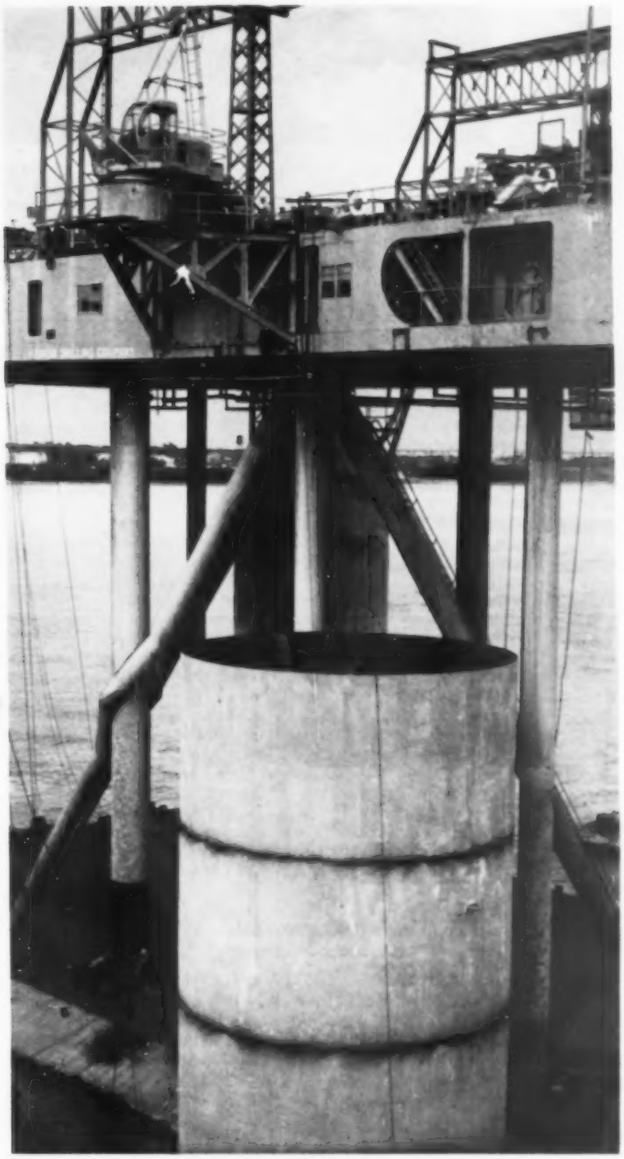

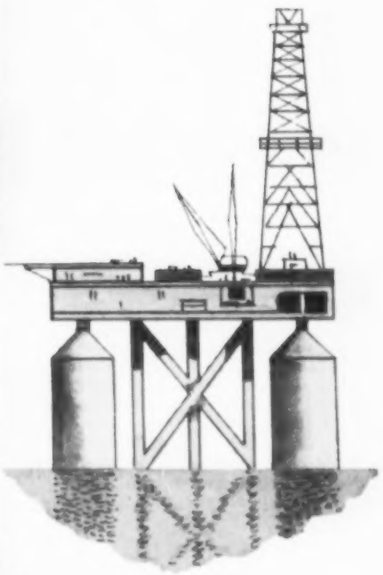

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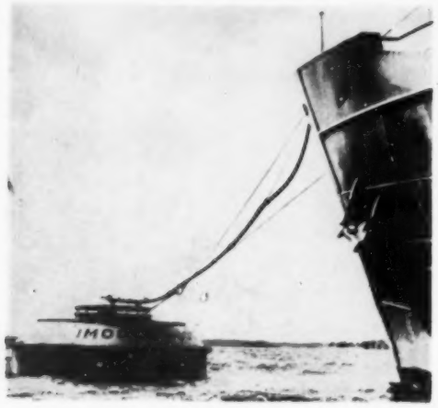
LONDON LETTER

by Cecil W. Wood



Buoy for Tanker Loading

A floating buoy has been designed by a group of Swedish and American engineers for offshore loading and discharging of tankers or bunkers. A. B. International Marine and Oil Development Corp. of Stockholm, has built a commercial model which was tested by the Swedish Navy.

The IMODCO buoy is a large circular structure which is anchored at a convenient offshore location. Submarine pipelines are passed through the buoy. In operation the tanker passes a heavy bridle to the buoy where it is secured to a specially designed hook. The buoy's hoses are then coupled to the ship's loading or discharging lines and cargo transfer proceeds through the submarine pipelines.

The buoy is so constructed that a ship moored by bow or stern can swing 360° around it, always heading into wind or current, whichever is stronger. Location may be in unprotected waters but still permit cargo pumping in weather when a ship normally could not approach a permanent dock.

Designers of the buoy suggest that its portability and rapid installation make it desirable for use adjacent to new fields.

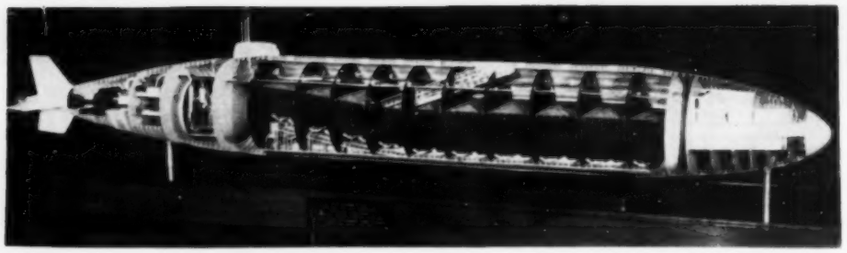
New Latex Plant Construction

An extension to International Synthetic Rubber Co.'s £ 6 million, 70,000 ton/year plant at Hythe (Southampton) is announced. Construction has started of a unit designed to produce 2½ million gallons a year of general purpose synthetic rubber latex.

Although only opened 11 months, it was claimed in September to have made the UK independent of overseas sources of synthetic rubber; in addition, the Hythe product had been exported to many foreign markets. Latex production is expected to start some time in 1960.

UK Oil Production

BP Exploration Co. reports production from its English oilfields at 39,827 tons for the first half of this year against 40,101 tons in the same period of 1958. The main producing oilfields are at Eakring and Egmanton (Notts.) and at Plungar (Leics.). Good progress is reported in developing the three new fields discovered last year—Bothamsall (Notts.) and Gainsborough and Corringham (Lincs.). Five successful producers have been completed at Bothamsall and probably 20 to 30 wells will have been drilled when the field is fully drilled up.



Nuclear Cargo Submarine Planned

British and Canadian interests have designed a nuclear cargo submarine which can be used for the transportation of ores or petroleum. First model of the "Moby Dick" is to be a vessel of 50,000 tons displacement, 607 feet long, 72 feet in diameter and designed to operate at 300 feet. First cargo will be 28,000 tons of iron ore. Maiden voyage is planned for 1964. Construction is to be at the Clydeside yards of Fairfield. Design has been developed by F. G. Mitchell, and W. A. Crago following extensive tank tests. A boiling water nuclear reactor power plant was chosen after tests of five types.

UK Consumption Up

With a half-year total of 17.9 million (long) tons, UK inland oil consumption (excluding bunkers) showed a rise of 2.7 million tons (18.1%) over the same period of 1958. This rise has special importance as it is the first half-yearly comparison for 3 years which is not influenced by the effects of the Suez blockade.

The trend to a heavy-oil economy remains pronounced. Fuel oil (excluding refinery consumption) accounts for 1.8 million tons of this increase and demand was 36.6% up on the 1958 figure: higher deliveries for electricity generation were the major factor in this rise. Though gasoline demand rose 6.5%, and consumers demanded 60.9% of this as premier fuel against 56.7%, the share required from the refiner of the total crude again declined. The drop in aviation fuel demand, at first surprising, is the result of a number of factors, some conflicting; broadly it may be said that increased civilian use was offset by lower use by armed services and the aircraft industry. There is food for thought, too, in the detailed figures on the continuing switchover from gasoline to diesel engines in goods and passenger vehicles and from vaporising to gas/diesel oil in agricultural tractors. The figures independently collated for the U.K. Petroleum Industry Advisory Committee can be summarized thus:

UK Oil Consumption January to June

	1959		*1958*	
	Tons	*Per cent*	*Tons*	*Per cent*
Aviation fuels ..	716,452	4.1	828,374	5.5
Motor spirit (a)	3,351,390	18.7	3,146,435	20.8
Industrial (b) and white spirits .	177,476	1.0	171,906	1.1
Kerosine	907,461	5.1	858,998	5.6
Derv fuel (c) ..	1,092,678	6.1	991,853	6.6
Gas/diesel oil ..	1,595,066	8.9	1,523,483	10.1
Fuel oil (d) ...	8,373,403	46.9	6,199,541	41.0
Lubricating oil and grease ..	445,240	2.5	426,586	2.8
Other products .	1,205,690	6.7	980,784	6.5
Total	17,864,856	100.0	15,127,960	100.0

The 1958 total was 31.1 million (long) tons.

Notes: (a) Includes motor benzole. (b) Includes industrial benzole. (c) Diesel engine road vehicle fuel. (d) Includes refinery consumption: 1959—1,199,861; 1958—1,166,918.

Equipment Orders Still Down

The value of orders for materials and equipment (excluding tankers) placed in the UK by oil companies has so far continued below the 1958 level. Figures compiled by the Oil Companies Materials Association and issued by the Council of British Manufacturers of Petroleum Equipment show the total for January to June this year at £ 56.7 million, a decline of £ 9.3 million (14.1%) from the corresponding 1958 total.

New Italian Refinery

The Italian ENI-AGIP group is considering entering the UK oil market. This was among the subjects discussed by its president, Signor Enrico Mattei, with city bankers during his recent visit to London. It is reported that the group's plans include not only the establishment of a chain of AGIP petrol stations but also setting up a refinery in the UK. Finance is no problem, said Signor Mattei, and no exchange marketing agreements with UK oil companies are contemplated. For the time being, however, the group is concerning itself solely with market research.

Larger-Life Flare Stack Head

A refinery flare stack designed and patented by British Petroleum has completed 5 years trouble-free service at the Kent refinery and has entirely eliminated flame licking under all weather conditions. The conventional steel tip it replaced lasted only 1 year. Its main design feature is the fitting of a wind deflector consisting of a number of vertical metal slats set at intervals on the periphery of the cylindrical burner hear and curving at their top ends towards the flare tip. A high degree of wind deflexion is thus provided but sufficient air flows between the slats and burner head to prevent the normal low-pressure zone being formed with its ensuing metal distortion and burning. At the same time the air helps to keep the flare tip cool.

Appointments

W. C. TOWNSEND has succeeded A. B. Lawrence, Jr., as managing director of Caltex (U.K.) and Caltex Lubricants, and as joint managing director of Caltex Trading and Transport Co. Ltd.

GEORGE WILLIAMS has been appointed project and development executive of the Wakefield Castrol group. He was formerly head of the group's international racing organization and is succeeded in this position by **JAMES HILL.**

G. Williams

A. Mosley

ALEC MOSLEY has been appointed public relations officer of Mobil Oil Co. Ltd., succeeding **PETER MATTHEWS**, who has joined Arthur Tooth & Sons Ltd., art dealers.

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(Above) This view of Platformer LPG recovery section shows deethanizer (left) and depropanizer tower (center). Third tower (right) is Unifining Unit's stripper column.

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Tulsa, Oklahoma

Harry A. Brown

In little more than three years after becoming the refining and marketing subsidiary of Sunray Mid-Continent Oil Co., DX Sunray Oil Co. launched a major modernization program.

In early 1959 we placed on stream at our West Tulsa refinery a 20,000 BPSD Unifining* unit, a 12,000 BPSD Platforming unit, a 2,400 BPSD Isomerization Unit and a 2,500 BPSD HF Alkylation unit. At about the same time we added at our Duncan, Oklahoma, refinery a 6,000 BPSD Unifining* unit to an existing layout which already included a 6,000 BPSD Platforming* unit, a 22,000 BPSD Fluid Catalytic Cracking unit, a 3,500 BPSD HF Alkylation unit and a 750 BPSD Catalytic Condensation unit. Installed at a cost of $12 million, and designed and engineered by Universal Oil Products Company, our new units are the most modern available and were installed to carry out our avowed objective of marketing high-quality products.

Triples high-octane output

The four UOP units provide more high-octane gasoline than the Tulsa refinery previously manufactured. The new Platformer almost triples the output of high octane gasoline there, and addition of the new HF Alkylation unit more than doubles DX Sunray's potential for producing 105-octane gasoline.

*Trademark

Being charged to the new Unifining unit is a blend of straight-run and coker naphthas for preparation as feed stock to two Platformers. These include a 7,500 BPSD reforming unit that was converted to UOP Platforming in June of 1956 and the new 12,000 BPSD unit completed this year. At relatively low cost, Unifining desulfurizes and purifies the Platforming feed stock and transforms olefins into paraffins. Combined operation with Platforming provides a most economical source for the hydrogen required in Unifining.

LPG unit recovers butane, propane

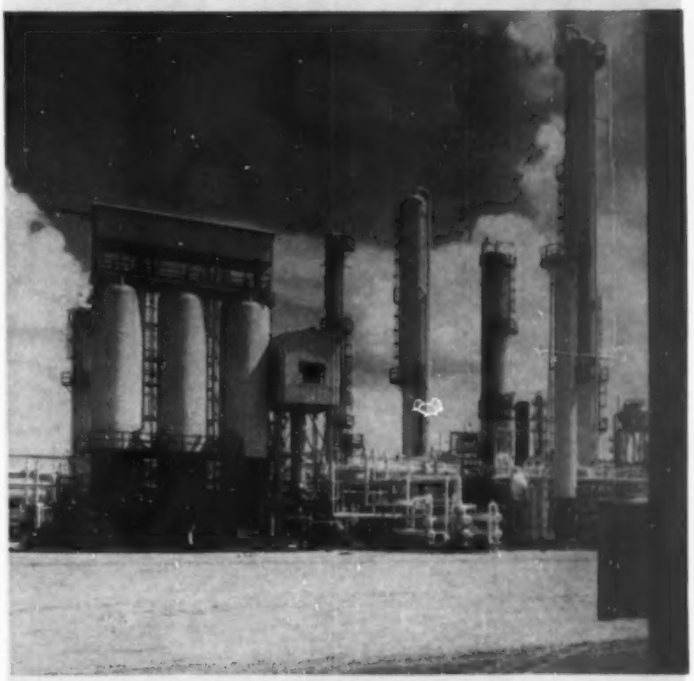
At the new Platforming unit, the Unifined, depentanized C_6-plus naphtha, or feed stock, is heated and contacted with a specially prepared platinum-containing catalyst under operating conditions to produce a C_5-plus gasoline with a leaded octane number as high as 99, if required. A rerun tower is provided for preparation of selected blending stocks. In conjunction with the Platformer there is an LPG unit designed to recover 92% butane and 60% propane.

In conjunction with the decision to modernize the Tulsa refinery, we gave careful consideration to future demands for higher-octane gasoline. Expanded facilities for alkylation, to produce motor alkylate as a blending component, were chosen since sufficient quantities of butane available in our refinery streams could be isomerized and, as isobutane, utilized as one of the feed stocks for HF Alkylation. Universal engineers, therefore, designed a 2,400 BPSD Butane Isomerization unit to service the HF Alkylation facility. The two processes are controlled and operated as a single unit.

Could produce 105-plus leaded octane

The HF Alkylation unit product is 2,500 BPSD of 105-octane gasoline blending stock. Actually, the unit would permit the Tulsa plant to turn out gasoline exceeding the 105 octane number (leaded) if market conditions should so dictate. However, DX Sunray has no immediate plans for producing motor fuels in such super ranges. If and when the need for higher-octane gasoline arises, we're ready for several years to come. Meanwhile, much of this high-octane alkylate is used to manufacture aviation gasoline. The remainder is blended with other refinery stock to produce a premium gasoline which is equal or superior in quality to any in the DX marketing area.

Combination HF Alkylation— Butane Isomerization unit assures potential production of super-octane gasoline



View of DX Sunray's Isomerization unit showing three reactors at left. Second tallest tower (center) is the debutanizer column. Deisobutanizer (right) is the highest refinery tower in Oklahoma.

UOP® UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road, Des Plaines, Illinois, U.S.A.
More Than Forty Years Of Leadership In Petroleum Refining Technology

ISOCRACKING* is here!

First commercial plant, now in operation at Richmond, California. Built by Bechtel.

LET BECHTEL show what this versatile hydrocracking process can do for you

ISOCRACKING PLANTS are available immediately through Bechtel Corporation and affiliated Bechtel companies—licensed to process design, engineer and construct plants employing this advanced new technique by its owners and developers, California Research Corporation.

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ANNOUNCING a significant advance in refinery technology available for license

ISOCRACKING

a commercially proven hydrocracking process

Today, in Richmond, California, the U. S. oil industry's first commercial Isocracking* plant is in full-scale operation.

Developed by California Research Corporation, the *Isocracking* Process is proving out benefits in refinery economics long predicted for hydrocracking. Under moderate processing conditions, *Isocracking* gives better than 100 per cent yield of over-103-octane gasoline blending stock from refractory light distillates.

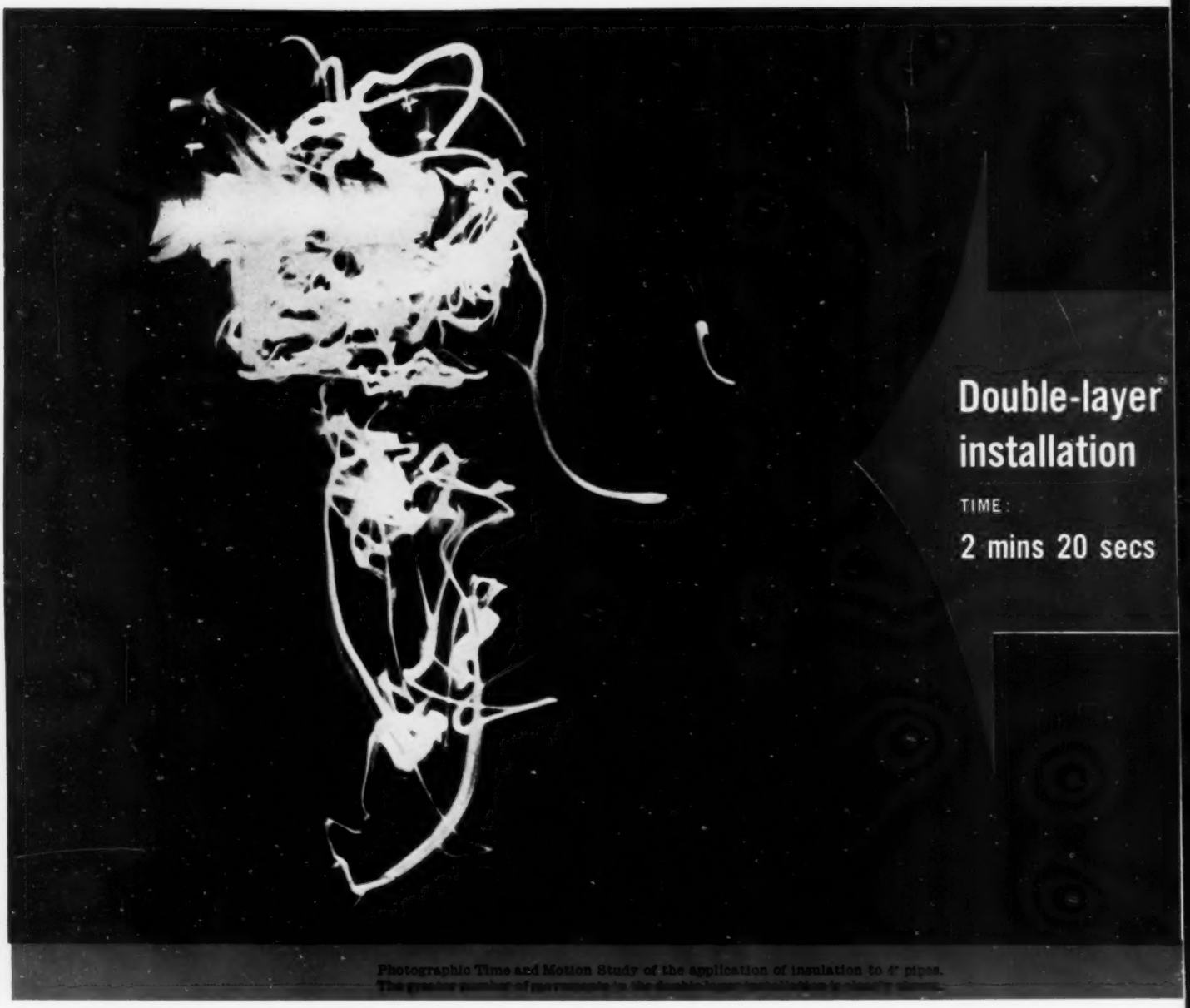
Highly selective in its ability to make the gasoline molecules most in demand, *Isocracking* permits direct manufacture of desirable blending stocks. It produces light isoparaffins in substantial volume. Moreover, it is a flexible process with a wide variety of refinery applications.

The *Isocracking* Process is offered under license by California Research Corporation, and pilot plant facilities are available for evaluation of feed stocks. **We invite you to discuss *Isocracking* with our engineers, at the Chicago API meeting, November 8-12.**

For complete details, write for brochure:
California Research Corporation, 200 Bush St., San Francisco 20, Calif.

CALIFORNIA RESEARCH CORPORATION
A Standard Oil Company of California Subsidiary

*Proprietary Name



Photographic Time and Motion Study of the application of insulation to 4" pipes.
The greater number of movements in the double-layer installation is clearly shown.

Avoid the two-layer tangle

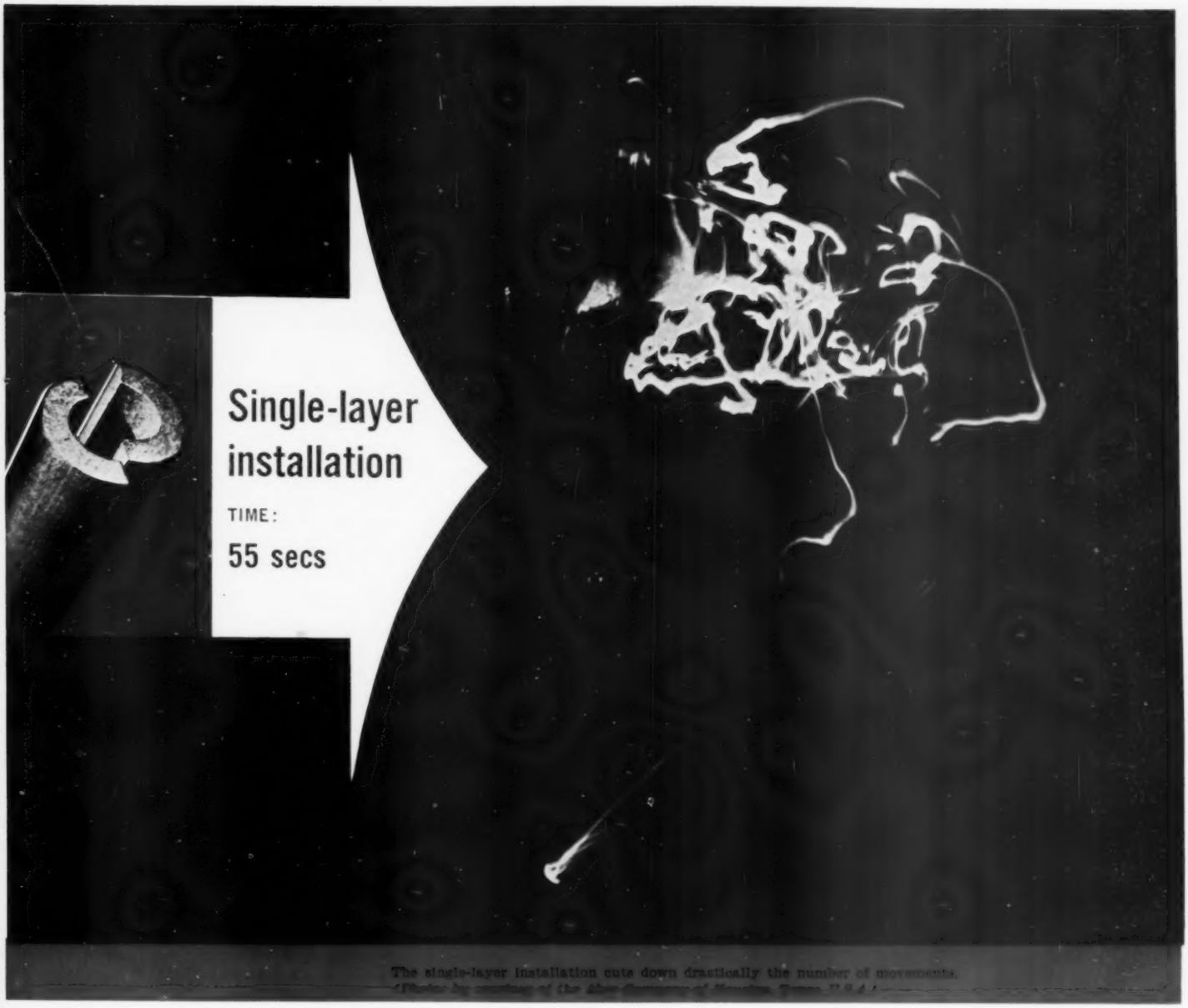
Insulation in a single layer! Caposite was developed by The Cape Asbestos Company to make the compromise of two-layer insulation unnecessary. Caposite does it in one—saving considerably on installation time and costs. Caposite, the amosite asbestos insulation, is designed to withstand temperatures up to 1000°F. without loss of efficiency.

LOW JOINT LOSS

The fibrous edges of Caposite knit together at the joints giving a good heat seal and making staggered joints unnecessary.

EASY TO HANDLE

Its inherent strength makes it possible to handle Caposite in large sections—for example at 2" thick for 30" n.p.s. —with very little damage and a further saving in installation costs.



The single-layer installation cuts down drastically the number of movements.

CAPOSITE

single-layer insulation

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A NEW ESSO RESEARCH & ENGINEERING CENTER

TO SERVE THE OIL INDUSTRY

The ESSO RESEARCH AND ENGINEERING COMPANY is proud to announce a new asset in its industry-wide process licensing program. Recently completed at Florham Park, New Jersey, is a new research and engineering center devoted to the development of improved refining processes and the design of modern, efficient refining and petrochemical units. The new facilities are ideal for development work on refining processes, an area of science in which this company pioneered. Equipment will feature automated pilot plants and high-speed electronic computers. As in the past, fully-developed processes will be licensed to the petroleum industry throughout the free world. The processes now available through the achievements of Esso Research and Engineering include Model IV Fluid Catalytic Cracking, Hydrofining, Powerforming, Fluid Coking, CAA Butadiene Extraction and many others.

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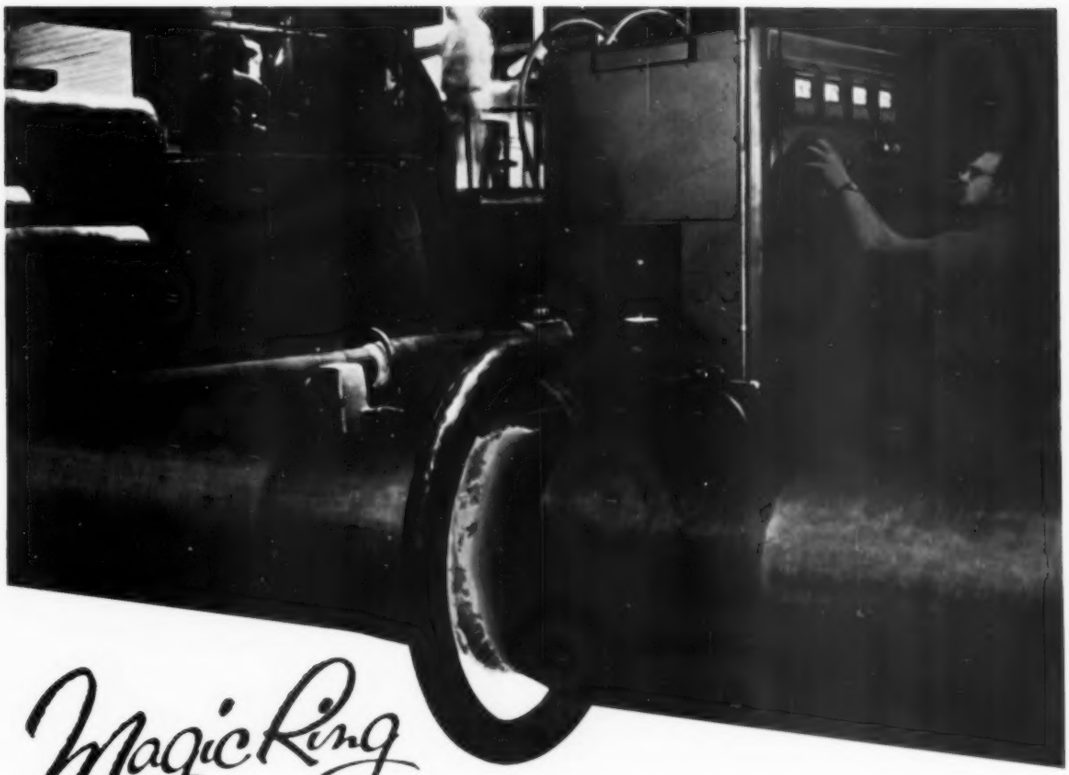


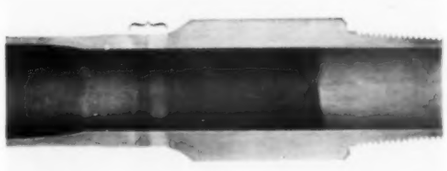
Magic Ring

makes Hughes Flash·Weld twice as strong!

A new process, developed by Hughes for heat treating "Flash-Weld" tool joint-to-pipe connections, has resulted in a major advance in drillstem construction. In this process an induction coil is used to normalize and stress-relieve the weld area—more than doubling the tension-impact strength of the connection.

Special electrical equipment, built to Hughes' own exacting specifications, performs this operation. After each joint is flash-welded to the pipe, the weld is automatically positioned inside the "magic ring." Induction heating to closely controlled temperature converts the metallographic structure within the weld affected area — ⅜" to ¾" on each side of weld—to a fine-grained, ductile, strong condition. After cooling, the weld is positioned in a second coil and heated to correct temperature for stress-relieving.

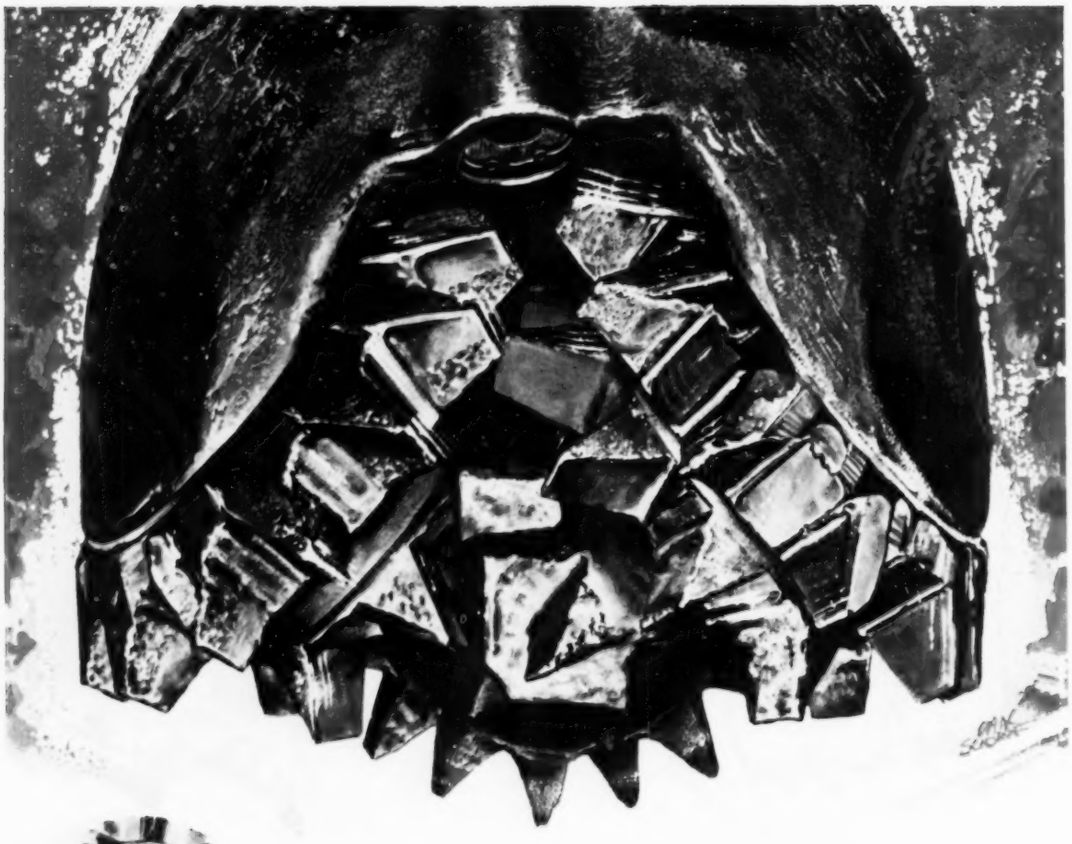
The result — proved in over 200 full scale tension impact tests — is a tool joint-to-pipe connection with metallographic uniformity across the weld that had not heretofore been available to the industry.

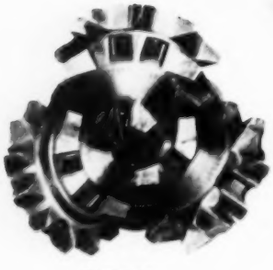


This cross-section of a finished "Flash-Weld" tool joint shows the very small area—only about ¾" on either side of the weld — that is affected by the new Hughes induction heat treating process. No other part of the pipe or joint reaches a temperature high enough to alter its metallurgical properties.

50TH ANNIVERSARY YEAR
1909 – 1959

FLASH-WELD
A DEVELOPMENT
OF
HUGHES
TOOL COMPANY
HOUSTON, TEXAS





18% FASTER
TOP HOLE DRILLING...
30% more hole !

OSC-3AJ

Newest of the top formation bits is the new Hughes OSC-3A and OSC-3AJ. In comparative runs, this bit has substantially outdrilled previous models. In some instances, drilling rate has been increased as much as 18%, and footage as much as 30%.

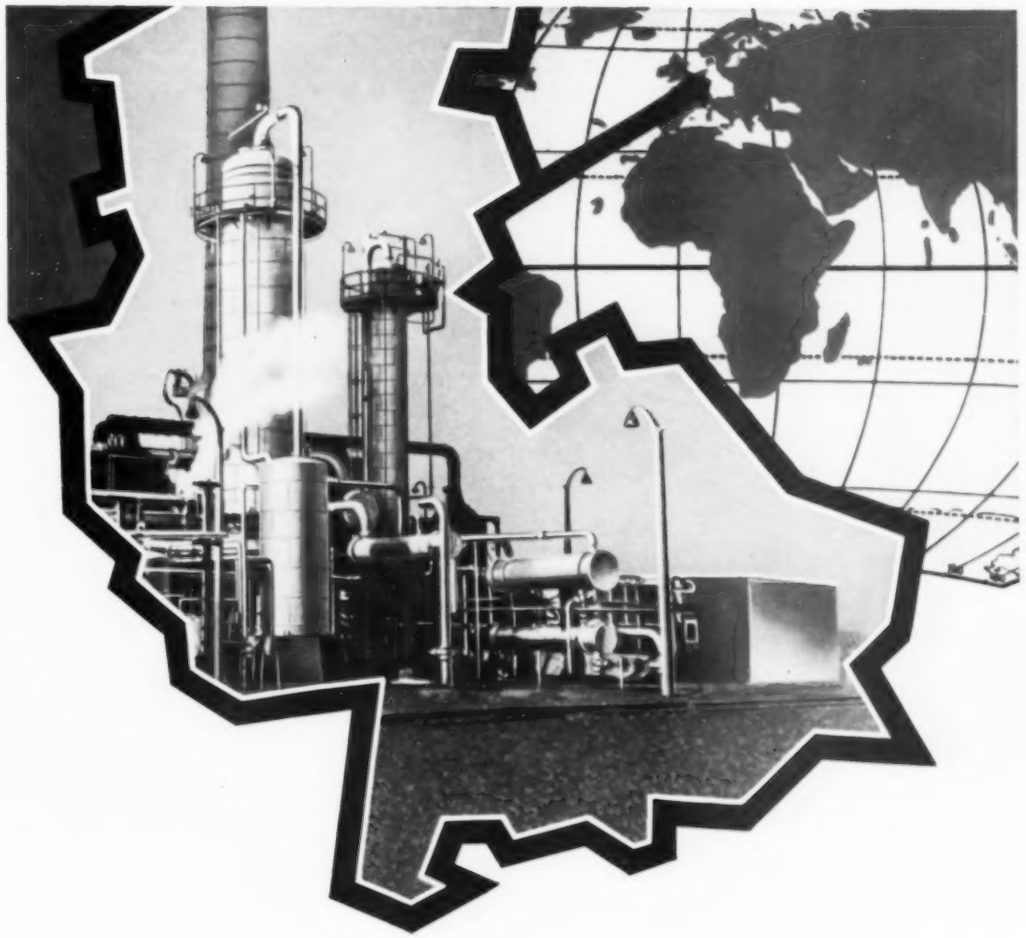
The new OSC-3A and OSC-3AJ have been designed specifically to drill the softer, more unconsolidated strata usually encountered in top hole drilling.

The new tooth shape and spacing were determined by extensive performance studies of designs based on the Hughes concept of removing a maximum volume of material from bottom with a minimum of direct contact between the teeth and the formation.

The OSC-3A and OSC-3AJ are currently available in sizes from 12¼" to 18½". In addition to top formations, many operators are using these new bits successfully in drilling medium soft formations.

HUGHES TOOL COMPANY

50TH ANNIVERSARY YEAR 1909 – 1959



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for the desulfurization by means of ethanolamine and sulfuric acid solutions of refinery and industrial waste gas.

Sulfur recovery plants and Sulfur casting machines in any desired size are designed and built by UHDE for the economical utilization of the sulfur.

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Filter installations including those for the removal of finest dust particles.
Vibrating conveyors and mono-vibrators (unbalanced motors).
High pressure vessels, valves and fittings.
Brown integral "one piece" heat exchangers.

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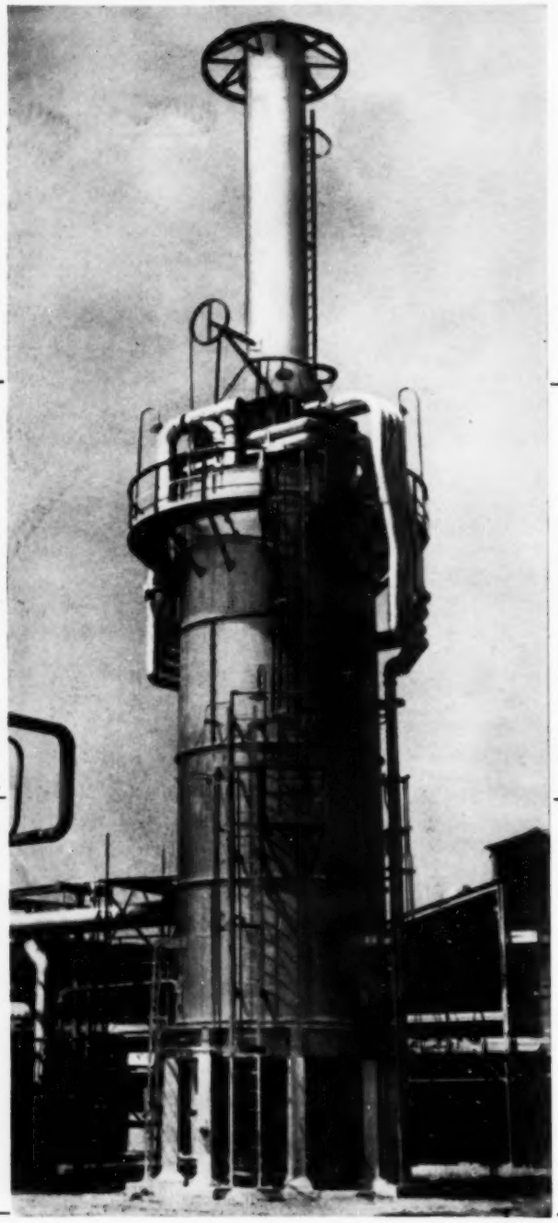
higher efficiencies



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low operating cost

negligible maintenance

less ground space

greater safety

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ARE THE WORLD'S FINEST HEATERS FOR OIL PROCESSING

THE superiority of Born Heaters can be clearly defined it terms that mean a lot to operators in the Petro-Chemical Industry. But there's more in Born Heaters than savings alone. Developing over 85% heating efficiency, without costly blowers, fans and other mechanical equipment, these heaters range from 500,000 to more than 200,000,000 BTU per hour absorption duty. And special Born features include the airtight plenum chamber, safe-guarding against external explosions, suspended tube arrangement, even heat distribution, removable wall panels, etc. Illustrated from the Born range above is the Born Vertical Heater, an ideal installation where space is limited. Find out all about Born Heaters and how they can work more efficiently for you. Your enquiries to any of the Companies listed below will bring full details and technical data.

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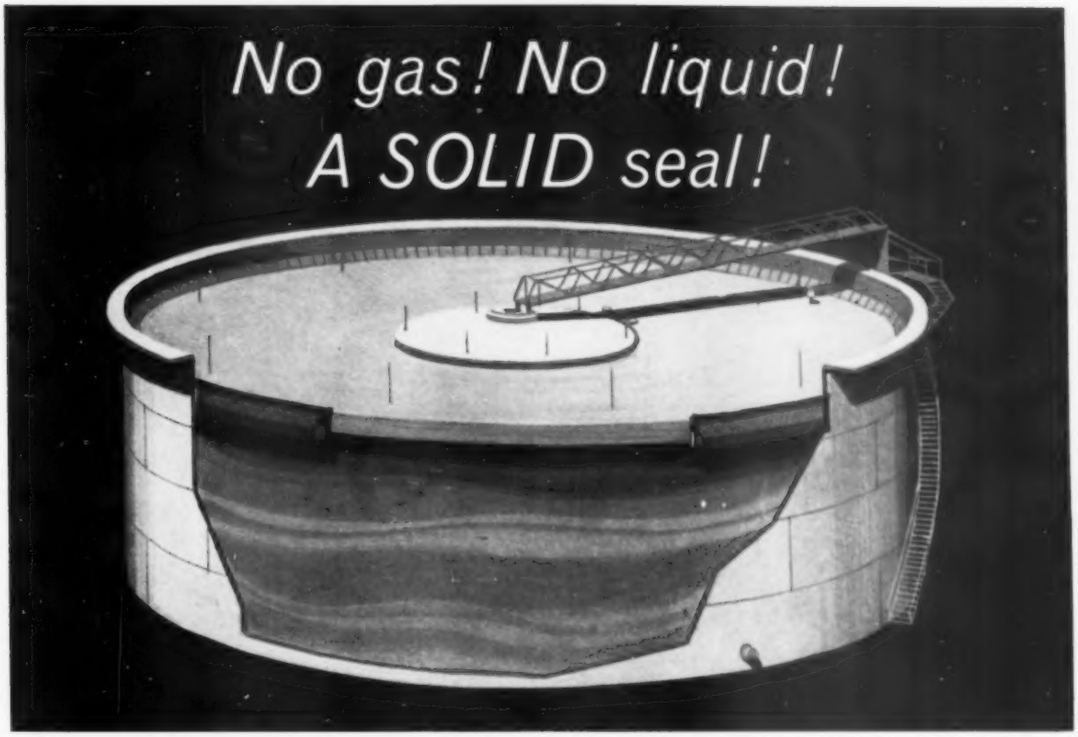

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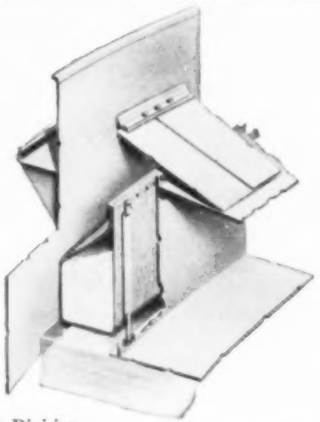
General American's new cushion seal for floating roofs

Tear it! Gouge it! Puncture it! The seal will hold. No matter what the damage, it will not burst or rupture! There's nothing in EVERSEAL to spill or leak.

Urethane cushions firmly joined and enclosed in a vapor-tight, no-scuff envelope of BUNA "N" and PVC are protected by the General American weather hood.

EVERSEAL resists the abrasive action of rough tank walls, yet will not scratch or damage tank coatings.

Get the complete details about EVERSEAL! Write the General American office nearest you. For any type of conservation structure, *it pays to plan with General American.*



WHY THE NEW GENERAL AMERICAN EVERSEAL IS FAR BETTER THAN ANY TUBE TYPE SEAL

1. No liquid or gas to leak
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7. Protected from sun, rain, snow and dirt by the General American weather hood
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*Patents Pending

Plate & Welding Division

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Quarter scale model of experimental gas turbine being developed by Cooper Bessemer and Pratt & Whitney Aircraft. Units should be available for use within 18 months.

How Cooper-Bessemer is teaming up with Pratt & Whitney Aircraft to develop JET TURBINE POWER for industry

The cutaway model shown is a revolutionary new concept in gas turbines. The generating unit is a new Pratt & Whitney Aircraft jet engine—a modification of the famous J-57 aircraft engine, designed for gas fuel. The companion power unit is a new Cooper-Bessemer power turbine. This combination, now in the advanced experimental stages, represents the hottest development in industrial power in 20 years. It will mean drastic economies in installations of engine-driven compressors, generators and other rotating machinery.

For example, in gas compressor stations, it is expected to reduce total station cost by 50%!

Plans call for this new gas turbine to be available for broad application within 18 months. In the meantime, watch for reports on further developments in this pioneering teamwork by Cooper-Bessemer and Pratt & Whitney Aircraft.

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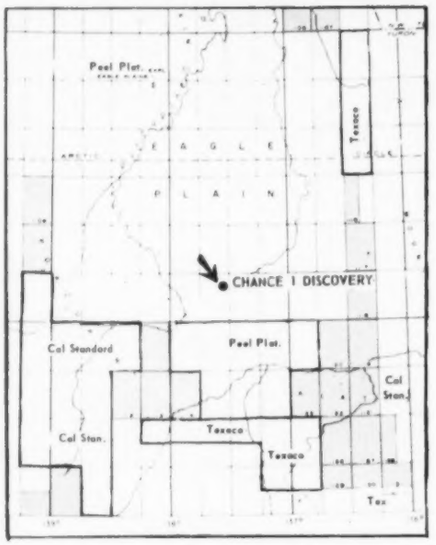
CANADIAN NOTES



Far North Strike In Canada

A wildcat in the Yukon Territory is holding the limelight as the first oil find in Canada's far north since the discovery of the Norman Wells field in the Northwest Territories in 1920. Advent of the well, located on the Eagle Plain reservation, about 20 miles south of the Arctic circle was hailed by Hon. Alvin Hamilton, Minister of Northern Affairs and National Resources, as a discovery which promises to "equal the largest previous oil discoveries in Western Canada." It is the first strike of any nature in history of the Yukon Territory.

The find was made by Western Minerals Ltd., a Canadian company, which serves as operator for a group of companies associated with Peel Plateau Exploration Co. in northern exploration. The companies include Central Patricia Gold Mines Ltd. and Conwest Exploration Co., both of Toronto. Holdings involve approximately 8,000,000 acres and reservations include the Peel block as well as the Eagle Plain block.

Western Minerals' Chance No. 1 well at Eagle Plains tested at 10 million cubic feet a day of natural gas. Open flow was estimated at 50 million. Hamilton's announcement said that light gravity oil was encountered in the lower part of the productive section at a 4,250-370 ft. interval. The unidentified oil-bearing zone of sand in the discovery well is believed to be about 140 feet thick unlain by a 400 foot band of limestone. At latest reports Chance No. 1 was still drilling. Final depth has not been specified.

Possibility that the well is the forerunner of a new major oil field in the Yukon has stirred speculation concerning possible construction of a pipeline about 450 miles to Pacific Coast tidewater.

This was the group's second drilling venture on the Eagle Plains reservations, the first effort having been suspended at over 9,000 feet. Results were negative. Chance No. 1 is drilling about 50 miles south of the first test.

Mobil Has Foothills Interest

Mobil Oil of Canada, Ltd. has purchased a 15% interest in 1,300,000 acres of oil and gas lands in the central Alberta foothills from Royalite Oil Co. Ltd., which held a 25% interest prior to the new agreement. The remaining 75% is owned by three other oil companies.

An extensive seismic and drilling program is underway in the 1,300,000-acre property. Of six wells completed, three resulted in significant gas discoveries, and three were dry holes. Four more exploratory wells are currently being drilled.

Trans-Canada's Gas

Trans-Canada Pipe Lines Ltd. now has approximately 7.5 trillion cubic ft. of natural gas under contract for its Canadian and proposed American markets. James W. Kerr, president, stated "Trans-Canada has a fully adequate volume of gas to take care of all its contracted Canadian sales and the Emerson export program. Actually, Trans-Canada has purchased 12% more natural gas than is required to fulfill existing contracts for the Canadian and American markets. This additional 12% is available for future Canadian requirements which are not yet covered by contract.

"Our all-out gas purchase program and the resultant substantial increase in reserves are indicative of our company's desire to expedite as much as possible the export program at Emerson, whereby Trans-Canada will sell 204 million cubic ft. of gas daily to Midwestern Gas Transmission Co.," Mr. Kerr added.

Shell Refinery Delayed

Shell Oil Co. of Canada Ltd. has announced that it will not start construction of its proposed Toronto area refinery until 1960 or 1961. The plant will have capacity of 20,000 to 30,000 b/d and will supply all Shell's product requirements for Ontario, displacing Quebec products manufactured from imported crude.

New Canadian Market

New export market for Canadian crude, probably medium gravity from Saskatchewan, is offered by a new refinery in Rapid River, Michigan, which has intimated it will take 1,500 b/d when it starts up next spring. Interprovincial Pipe Line Co. has published tariff for Rapid River as potential delivery point.

Gas Earnings Revision Due

Major revision of earnings calculations will have to be made for all export gas pipeline projects in light of greatly increased interest rates on bond financing since plans were started. Similar adjustment will be required for Alberta Gas Trunk Line, which is obligated to build new facilities if permits are granted. Difference of 1% in funded debt charges could involve close to $1,000,000 per year for Trunk Line's foothills division.

Canada's Well Completions Down

The most severe slump in Canadian well completions this year occurred in August, with only 188 wells drilled, a drop of 21% from August 1958 when 237 wells were completed. Alberta lost 19% and Saskatchewan was down one third. Manitoba and B. C. gained slightly. Cumulative 8-month total was 1,654 wells, down 3% from 1958 period total of 1,705 wells.

Helium Search On

Saskatchewan is the scene of a widespread helium search by two major oil companies. Sun Oil Co. has recently entered the search. British American Oil Co. Ltd. already has announced discovery of helium content gas. The company likely will evaluate this discovery in a report to the Saskatchewan government in the near future. The strike was made in the Swift Current area where BA has permits on 171,000 acres. Sun has been granted permits in the Swift Current area covering about 266,000 acres.

Athabaska Atomic Blast

Proposals by Richfield Oil Corp. for an underground nuclear explosion in Alberta's oil sands region have taken a step forward with endorsement by an Alberta government technical committee which has been studying all aspects of the project with emphasis on public saftey factors. This follows earlier approval by a technical committee which was set up on the federal level to study feasibility of the Richfield proposal. No exact date has been set for the blast which is expected to release a portion of the billions of barrels of oil long locked in the Athabaska region.

Northern Islands Drilling

An intimation has been made by Hon. Alvin Hamilton, Minister of northern affairs, that drilling may commence soon in the Arctic Islands. The minister did not disclose what company is involved but he said that plans have been advanced for at least one well within the next few months.

Production Over 500,000 B/D In '59

Canadian crude oil production is almost certain to exceed 500,000 b/d average for 1959, according to projections by Alberta and Saskatchewan conservation boards. The estimate is based on refiners' nominations and extrapolations of demand. This would top the previous record of 496,000 b/d set in 1957 by about 1%. It will be a new high for Saskatchewan production but only the second best year for Alberta.

Canada's North Wildcat

Scurry-Rainbow Oil Ltd., is moving drilling equipment into the Northwest Territories to initiate Canada's most northerly drilling venture, following extensive geological survey during the last two summers.

The company's announcement stated: "The well, Scurry-Rainbow Grandview Hills N.W. T. 1, will be located in the Grandview Hills area downstream from Fort Good Hope, 18 miles west of the Mackenzie River. It will be the first well to be drilled in the Northwest Territiories within the Arctic Circle and Canada's most northerly wildcat. The closest well control is in the Norman Wells area 150 miles to the southeast and in the Eagle Plains area in the Yukon 200 miles to the southwest where a large gas and oil discovery has been reported recently."

The wildcat is intended as a basement test and will core and test all porous zones. Upon completion, logging equipment will be flown into the area for thorough evaluation of the full section. Drilling contract has been awarded to Peter Bawden Drilling Ltd., Calgary, which will use for the project a slightly modified rig capable of drilling to a depth of 8,000 ft. Standby equipment will be maintained on the location.

Failing Ltd. Appointment

J. W. Cooper has been appointed manager of the George E. Failing Supply Co., Ltd. of Edmonton, Alberta. Cooper has been associated with the Canadian operations of the Failing Company since 1945. Previously he was employed by Union Tractor Co. of Canada. Jimmy Helton, who managed the Failing Canadian subsidiary for the past four years, has been made West Coast District manager with headquarters in Oakland, California.

New Books

Source Book of the New Plastics—by Herbert R. Simonds. A review of the new plastics: their properties, production, price, applications and selection. Sixty plastics producing companies contribute articles describing their own materials. These materials include the seven new primary plastics of 1958. The book also describes the significant recent improvements in established plastics, and the 100 most important patents issued in the plastics field for 1958. Cost is $6.95. Published by Reinhold Publishing Corp., Dept. B-334, 430 Park Avenue, New York 22, N. Y.

Performance of Lubricating Oils, Second Edition. By H. H. Zuidema, Shell Oil Co. This new edition of a monograph summarizes and evaluates data on the performance characteristics of lubricating oils under various conditions. It incorporates the many papers on the subject published since the first edition. Selected references add to the bibliography in each chapter, and corresponding revisions and additions appear in the text. The book amply supplies helpful charts, tables and illustrations. Published by Reinhold Publishing Corp., Dept. B-332, 430 Park Avenue, New York 22, N. Y.

Lessons in Seismic Computing. A compilation of lessons by Morris Miller Slotnick, edited by Richard A. Geyser of the Humble Oil & Refining Co. This is a unique and very useful book, published under the aegis of the Society of Exploration Geophysicists (SEG) containing 44 lessons in seismic computing in 268 pages. It is a very advanced treatment, mathematically, but some provision has been made for persons "mathematically weak" by giving practical results as well. Available through the SEG, 107 West 15th St., Tulsa, Oklahoma.

Tax Incentives for Industry in Mexico. By Ross and Christensen, Harvard Law School, International Program in Taxation. This 226-page booklet is of more use to students or possibly government personnel than to industry. It deals with the effects of tax incentives on Mexico's development and finds them not very effective. Published by Law School of Harvard University, Cambridge, Massachusetts. No price is given.

1. FABRICATION of all types of equipment (Fractionating Columns, Gas Columns, Pressure Vessels, Plate and Heavy Steel Work, Special Machines, Autoclaves, Shells, Bridge Girders) is performed to order, to specification.

2. MACHINING—Fully equipped, flexible facilities for machining to close tolerances, regardless of product size or design.

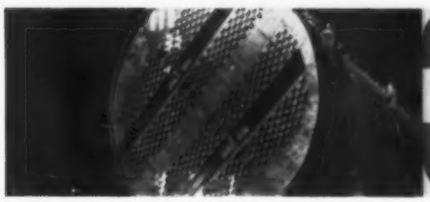
3. STAINLESS—Separate, integrated shop for stainless fabrication protects against contamination by ordinary steel.

4. DELIVERY by rail, truck or inland, coastal or overseas waterway.

POTENTIAL

FABRICATION

2 MACHINING



3 STAINLESS

4 DELIVERY

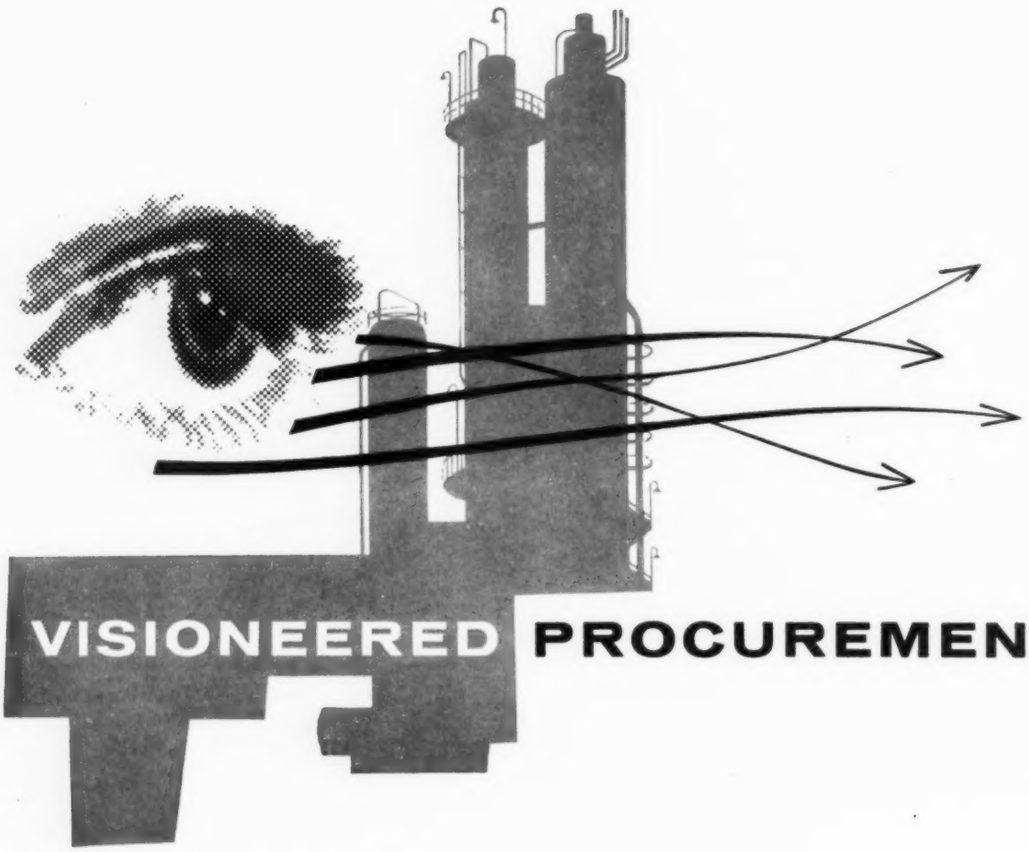
Through integrated, efficient operation, Sun Ship can reduce costs, increase your POTENTIAL. Call for an estimator or representative.

Sun

SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE • SINCE 1916 • CHESTER, PA.

intangibles were never so important



VISIONEERED PROCUREMENT

Procuring the innumerable items for construction of a petroleum, chemical or petrochemical plant is a complex undertaking requiring a high degree of experience and foresight. Working in close coordination with estimating, engineering, drafting, field construction, inspection and expediting personnel, the Procon purchasing staff provides many intangible services of inestimable value. This is another reason why a Procon-built plant is economical in cost, completed on time and superior in performance!

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PROCON (CANADA) LIMITED, TORONTO 18, ONTARIO, CANADA

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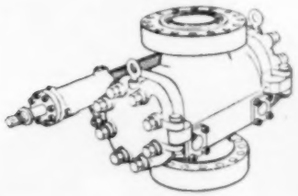
WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

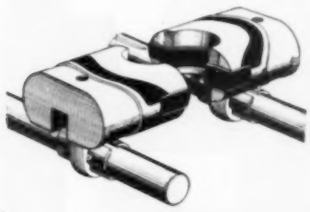
"... WITH SO MUCH AT STAKE TAKE CAMERON EVERY TIME."

The most important part of your rig can be your blow-out preventer system.



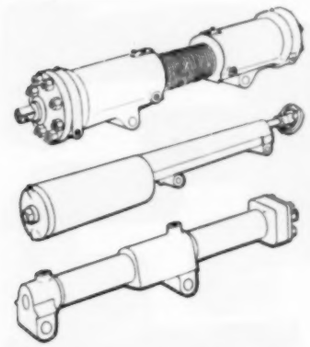
Cameron Type "F" Blowout Preventer—latest design in almost 40 years of leadership.

When you are drilling, you're looking for pressure—and higher pressure means higher profit.

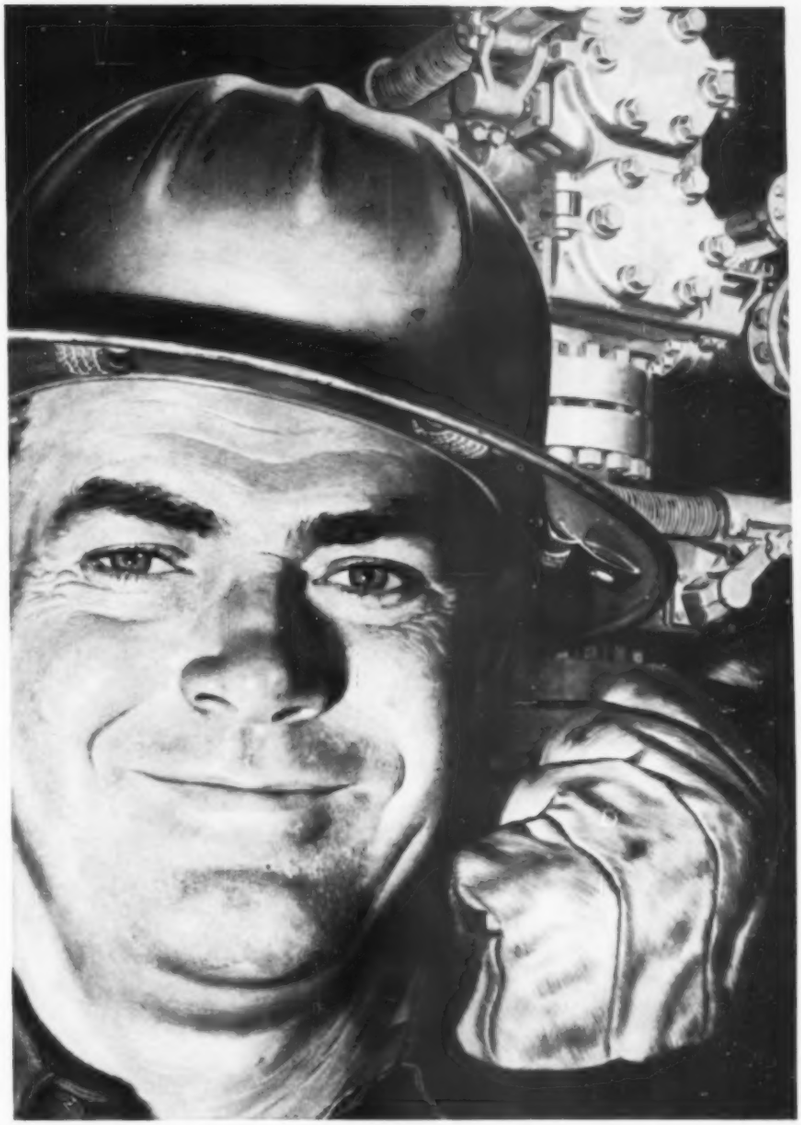


Ram actuator shafts rotate—are sealed at both ends to produce pressure balance for extra-easy operation.

But the difference between success and failure can depend on your ability to control down hole pressures.



Type "F" Preventers are available with interchangeable operators for hydraulic, air or manual service.



Since we developed the first successful preventer, almost 40 years ago, a majority of successful operators all over the world have relied on the safety, service and economy of our efficient units.

Cameron Type "F" Preventers are the latest design in our development program, which, incidentally, is continuous at Cameron.

Early in our history as a company it became obvious that intermittent design work cannot meet the rush toward greater depths and higher pressures. As a result, we have always been ready with equipment to handle each new drilling requirement.

Close and continuous observation of pressure problems in drilling has shown that the best Blowout Preventer is the only bargain. This is the reason we say ". . . with so much at stake, don't take chances, take Cameron every time."

Cameron

IRON WORKS, INC.

P. O. Box 1212 — Houston, Texas

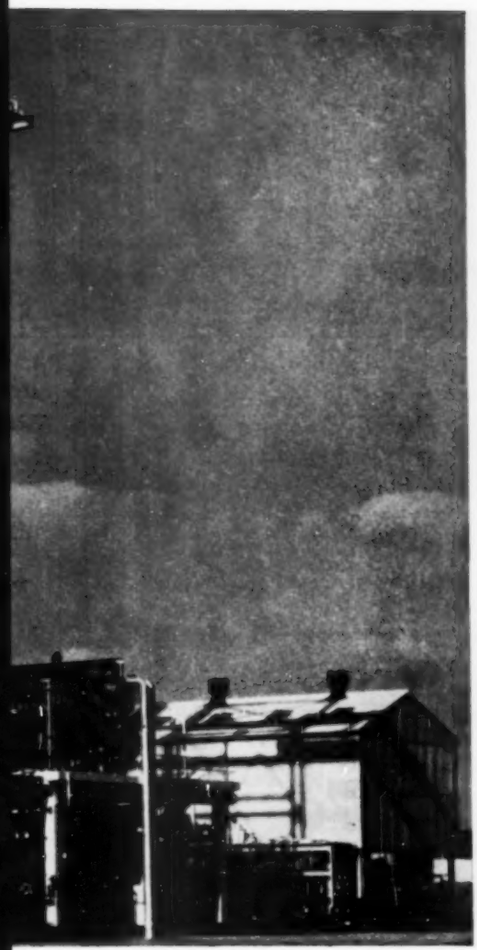
Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., 76 Grosvenor St., London W. 1 England

Outstanding performance Shell trickle process

t r i c k l e

and economy with

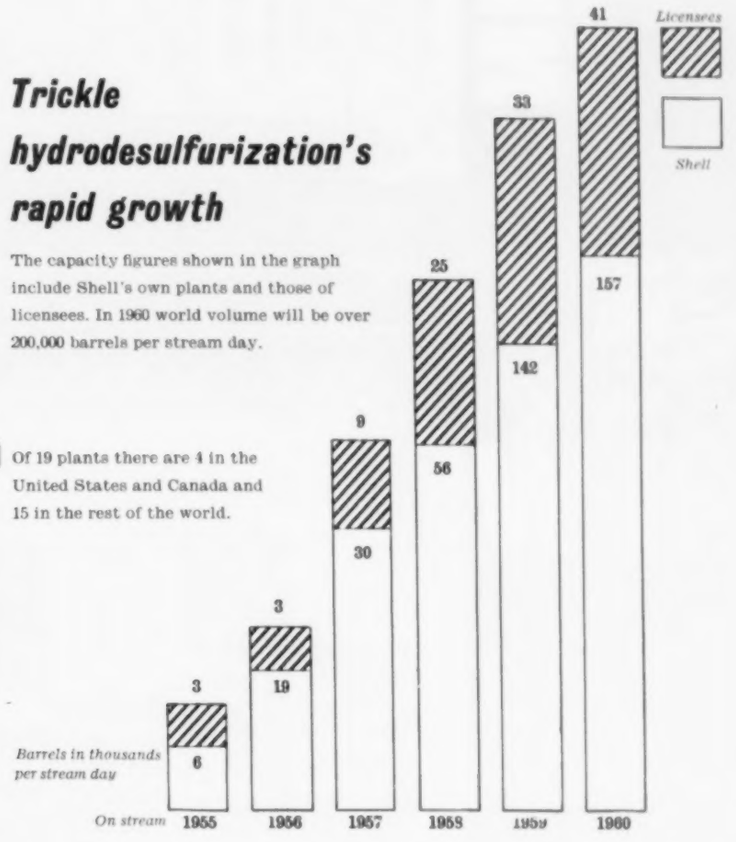
Substantial economies in both capital and operating costs result from relatively low hydrogen recycle rates with only part of the charge vaporized. Sulfur elimination of 85-90% from middle distillates is readily achieved. The process provides notably long runs between infrequent catalyst regenerations to initial activity. Although used commercially for the first time only in 1955, Shell's Trickle Hydrodesulfurization Process is now widely accepted in the industry.

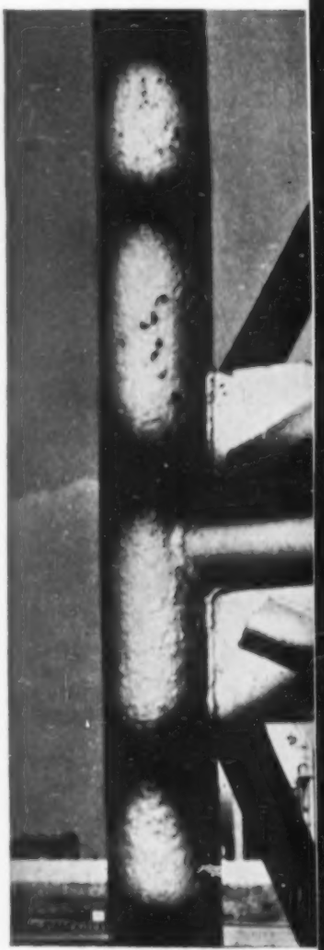


Trickle hydrodesulfurization's rapid growth

The capacity figures shown in the graph include Shell's own plants and those of licensees. In 1960 world volume will be over 200,000 barrels per stream day.

◀ Of 19 plants there are 4 in the United States and Canada and 15 in the rest of the world.





hydrodesulfurization

There is also available a Shell process for the vapor phase hydrodesulfurization of light fractions

Inquiries should be addressed:

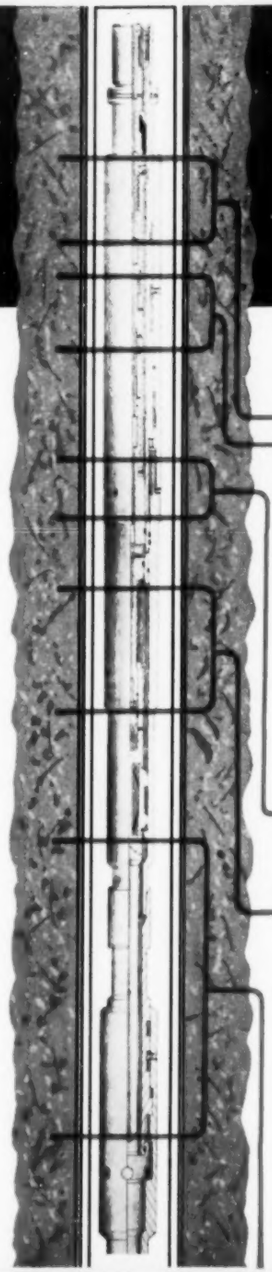
For plant locations in U.S. and Canada to: Shell Development Company, 50 West 50th Street, New York 20, New York.

Elsewhere to: Bataafse Internationale Petroleum Maatschappij N.V. 30 Carel van Bylandtlaan, The Hague, The Netherlands (P.O. Box 162).

NEW

JOHNSTON TESTERS FULL-BORE TEST AND COMPLETION TOOL

Now, you can make all the savings in round trips and rig time that result from using a combination test and completion tool without the disadvantages that sometimes result.



NEW

THE UNIQUE LOCKING SYSTEM makes it possible for the testing valve assembly to hold pressure in either direction; therefore, tubing or drill pipe may be pressured-up at any time while going in the hole without the use of any additional equipment.

TEST VALVE IS EASY TO OPEN—Simply pick up on tubing, torque slightly to the right and set down. The action is positive and there is no chance of "getting lost" by extensive rotation.

VALVE SYSTEM OFFERS MANY ADVANTAGES—**First,** initial shut-in pressure can be taken very quickly with only a minimum flow of formation fluid. **Second,** since the test valve closes before the circulating valve opens, mud from the annulus cannot contaminate the formation. **Third,** valuable rig time is saved because you can reverse circulate while taking shut-in pressures. This "circulating" feature also keeps sediment from collecting on top of the testing valve assembly for easy retrieving.

EXCLUSIVE JOHNSTON TESTING VALVE ASSEMBLY is rugged and dependable. Because of the valve arrangement and the recording assembly, you can take as many bottom hole shut-in pressures as you want without returning test section to surface. This means more information from your test. Later tests may be made by simply pumping the test section back in place.

***No rotation is necessary* with this tool during drill stem testing operations.**

You can take as many bottom hole shut-in pressures as you want without returning the testing valve assembly to surface.

You can also squeeze cement, re-perforate, fracture or acidize without ever pulling the tubing or drill pipe.

Then, if you need later tests, you can pump the pressure test section in place without ever making a round trip.

You can do all these things with full assurance that you are using a positive tool that is completely safe in operation. There is no guesswork. All operations involve simple up-and-down movement or a minimum of right hand rotation. No damage results from excessive rotation. No left hand rotation is ever required.

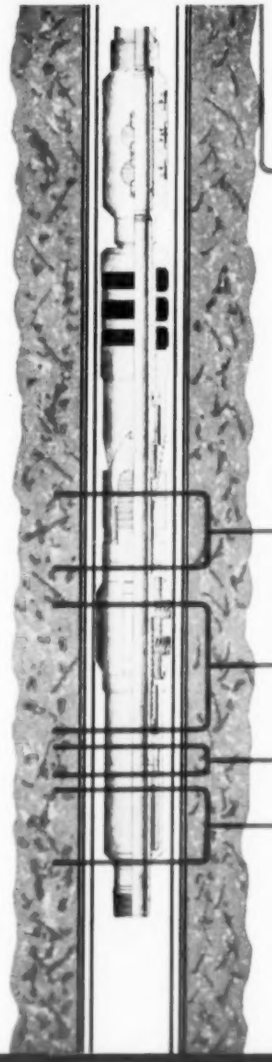
After all operations are completed, a built-in jar assures packer unseating when unseating is desired.

In addition, this tool is backed by Johnston Testers —the largest operator in the field of drill stem testing. You get all the advantages of Johnston's unparalleled experience when you specify the *Johnston* Test and Completion Tool. Fill out the coupon or drop us a note on your letterhead for full information. Please refer to bulletin number 8.

Please send me complete information on the New Johnston Full-Bore Test and Completion Tool.

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____

A.62



JOHNSTON TYPE "T" PRESSURE RECORDER gives unfailing accuracy, sensitivity and dependability under all testing conditions. This recorder is built to withstand unavoidable oil field jolts and is not apt to be knocked out of calibration. Non-tension type recorders may.

TWO-WAY ANCHOR SLIPS enable the operator to take a strain on the tubing without unseating the packer.

BUILT-IN JAR makes it easy to unseat packer. As in all other operations, no left hand rotation is required to operate or reset.

SIMPLE SETTING OF PACKER. Just pick up, torque to the right and slack-off, and the packer is set. The by-pass valve, which is closed when the packer is set, has a simple and positive opening and closing action.

FULL OPENING THROUGH TOOL (when testing valve assembly is out) permits perforating, squeezing, and other operations without difficulty.

PATENTS APPLIED FOR

JOHNSTON TESTERS, INC.

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Wherever air drilling solves the problem ... Gardner-Denver has the answer

- Air drilling
- Aerated mud
- Muddiated air
- Mist drilling
- Gas drilling
- Restoring lost circulation

THERE'S NO SUBSTITUTE FOR MEN

100 years of customer confidence. Side by side with "roughnecks," the Gardner-Denver man finds himself out on lonely offshore barges or in oil fields scattered throughout the world—always keeping a careful eye on his equipment's performance.

A background of experience in developing compressors and devising techniques for every phase of air drilling provides Gardner-Denver specialists with a fund of knowledge that's at your service wherever compressed air may solve a drilling problem for you.

Alaska, Canada, United States, Mexico, Australia . . . Guatemala, Honduras, the Bahamas . . . Turkey, Libya, Algeria, Saudi Arabia. Wherever air drilling has been put to work, Gardner-Denver specialists have worked side by side with drilling crews.

In scorching desert temperatures of 135° . . . at 55° below in the Arctic . . . at sea level . . . or at altitudes of 10,000 feet, Gardner-Denver equipment has passed the toughest test of all—field experience.

Specify Gardner-Denver compressors with confidence for air drilling any size hole to any depth, with seismograph rigs or with the largest of land-based or offshore rigs.

Consult your Gardner-Denver air drilling specialist—or write for further information.

GARDNER-DENVER Since 1859 — 1959 YEARS

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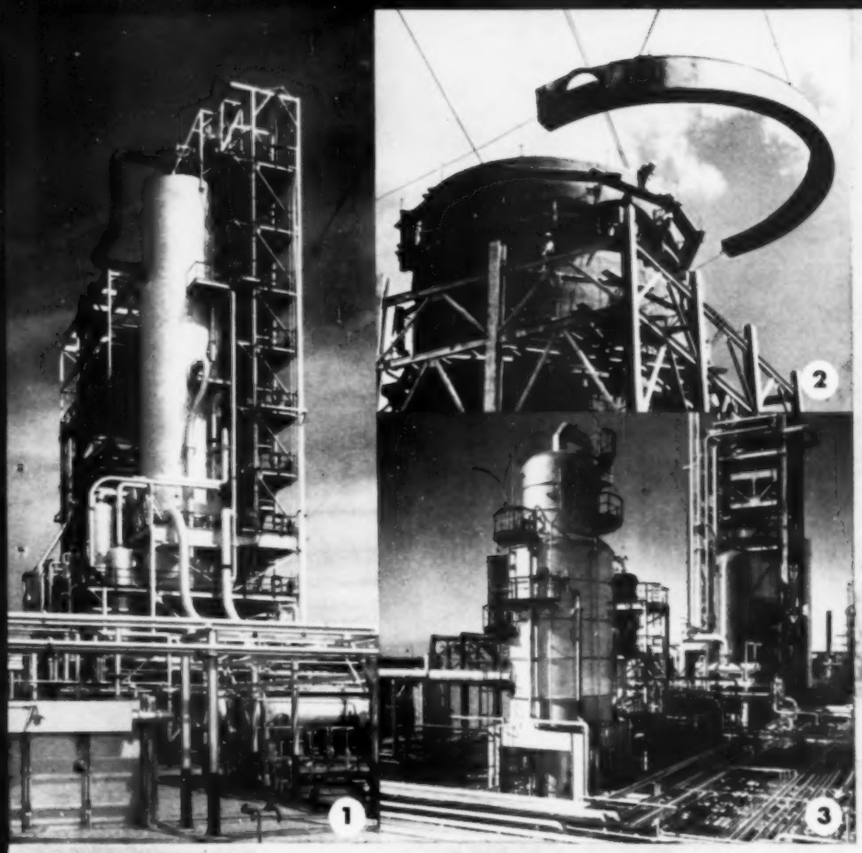

1. 9-ft. diam., 116-ft. high fractionating tower built for Creole Petroleum Corp. Ltd. at Amuay Bay in Venezuela.

2. Air duct section for *first* type TCC Thermofor unit built, is raised at Capuava Refinery in Sao Paulo, Brazil.

3. 63-ft. high vacuum column partially clad with 405 stainless steel built by CB&I for Petroleo Mexicanos Minatitlan refinery.

4. Gasoline stabilizer, high and low pressure absorbers and oil still—just a few of the extensive CB&I-built equipment erected for Phillips Oil Company at San Roque, *Venezuela*.

Where There's Refining ...There's CB&I

The ability to expertly coordinate the design, engineering and fabrication and to erect tanks and refinery processing structures *anywhere in the world* is a specialty and an art with CB&I. To petroleum executives everywhere, CB&I offers the advantage of one source and one responsibility to meet the most exacting processing requirement. CB&I offers too, the distinct advantage of placing our *global representation* at your service. It is for these reasons that, wherever in the world you find refining . . . you'll find the experienced *craftsmanship in steel* that is CB&I. Write our nearest office for details.

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P66CB

The Valve Complex on the Shell-B.P. Petroleum Development Company of Nigeria Limited's discovery well at Oloibiri, Nigeria.

The positive tightness of *Newman-McEvoy* VALVES

Automatic sealing, self-aligning gates and non-distorting seats combine to give unquestionable 100 per cent tightness at all times and in all circumstances. An independent sealing system operated by line pressure on each side of the valve stops leakage as it starts. Stem packings and bearings are easily replaced under full line pressure. Proved under hardest working conditions.

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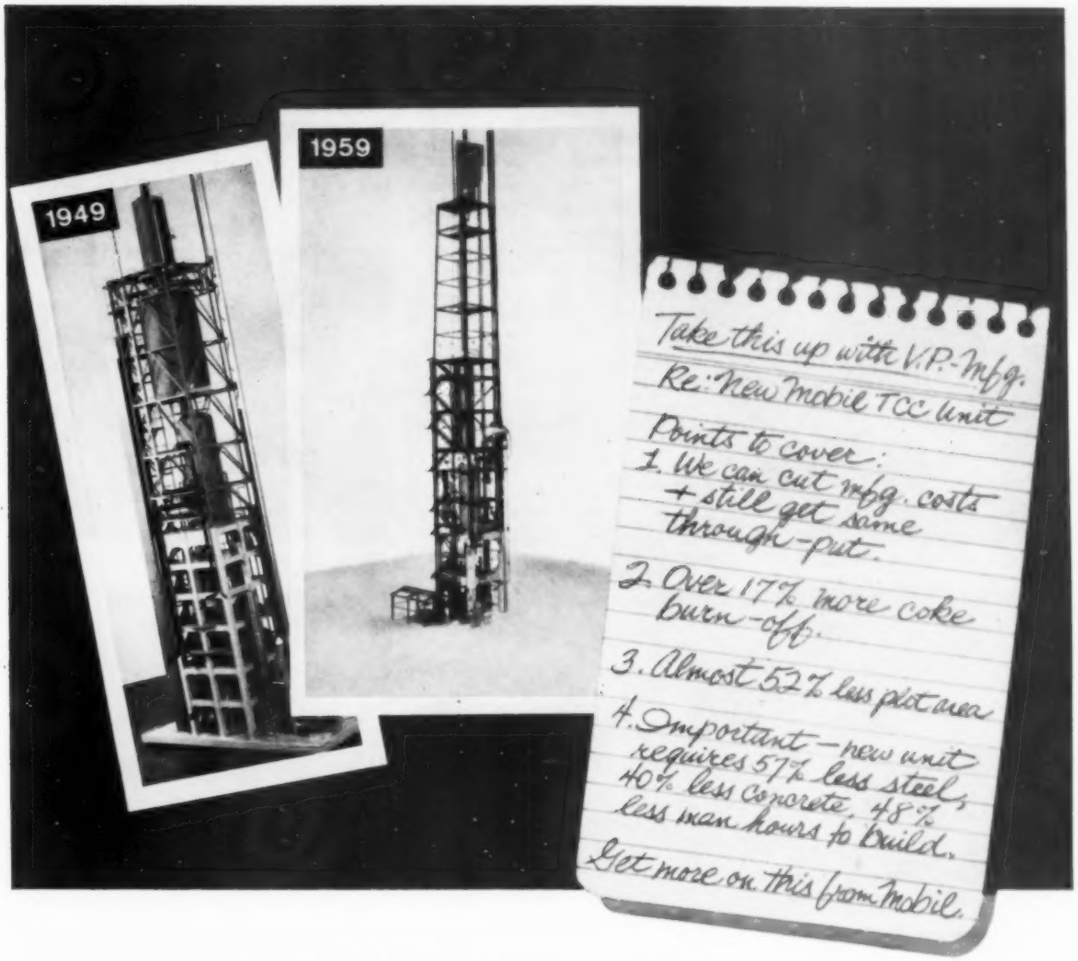
IMPORTANT ADVANCE FROM MOBIL RESEARCH...


1949
1959
Take this up with V.P.-Mfg.
Re: New Mobil TCC Unit
Points to cover:
1. We can cut mfg. costs + still get same through-put.
2. Over 17% more coke burn-off.
3. Almost 52% less plot area
4. Important—new unit requires 57% less steel, 40% less concrete, 48% less man hours to build.
Get more on this from Mobil.

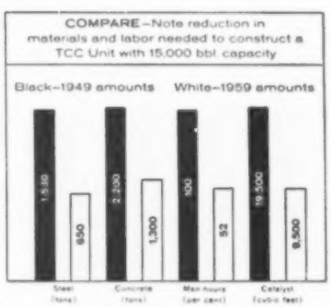
New TCC Units greatly reduce capital investment and operating costs

Since Socony Mobil developed the first Thermofor Catalytic Cracking unit during World War II, Mobil engineers have been steadily improving the basic TCC process and lowering construction costs. The figures speak for themselves—in the past ten years, steel requirements have been reduced by 57%, concrete by 40%, construction man-hours by 48%.

Not only are the new TCC units less expensive to build, operating costs are lower, thanks to Mobil's new bead catalyst, Heavy Durabead. Today's TCC yields more salable products from every barrel of crude oil.

There are many possible over-all processing procedures and cracking yield patterns for a given crude oil. Mobil is prepared to work with a TCC licensee to determine the best plan for his particular needs. Inquiries about TCC should be directed to Process Promotion Department, Socony Mobil Oil Company, Inc., 150 East 42nd Street, New York 17, N.Y.

Lower cost TCC Units . . . Another example of how Mobil research pays off by holding down the cost of gasoline.



Socony Mobil Oil Company

Leader in refining research

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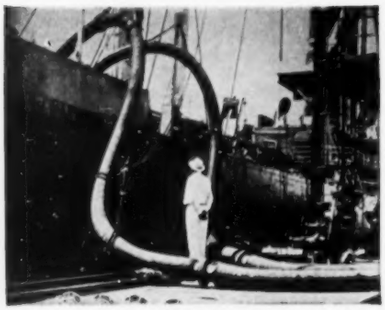
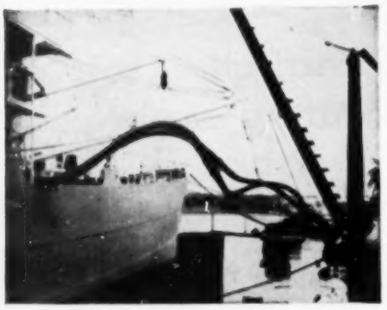
When you need top hose performance and value regardless of the job, you can always count on Hewitt-Robins Hose. It's engineered to match the toughest operating needs.

The complete line of Hewitt-Robins Hose is recognized as the leader throughout the entire petroleum industry. That's why you will always find it pays to specify Hewitt-Robins Hose for your needs. It's safer, lasts longer and is more economical.



O S & D HOSE

ROTARY DRILLING HOSE



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LP Gas:
*Bottling
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*Burner
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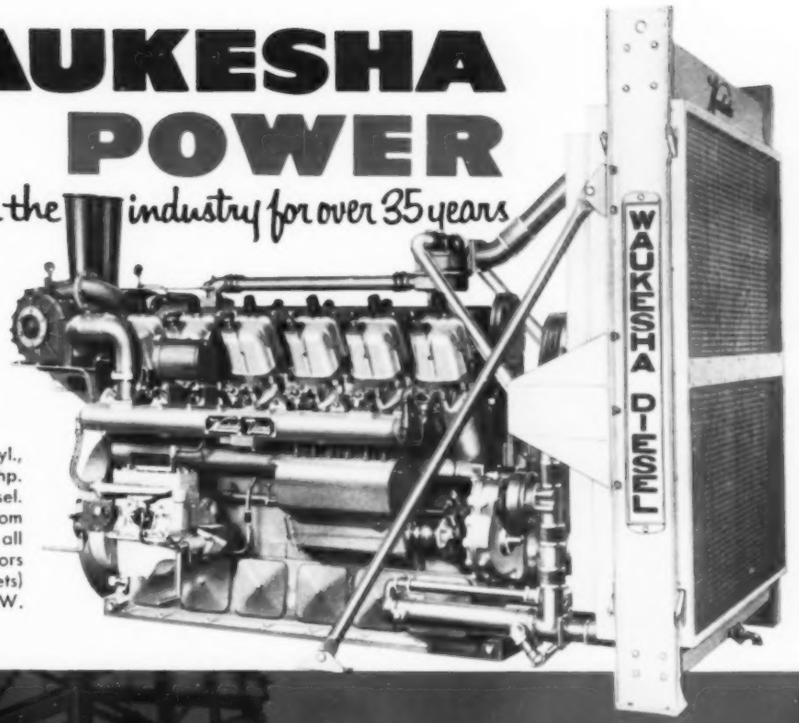
WAUKESHA POWER

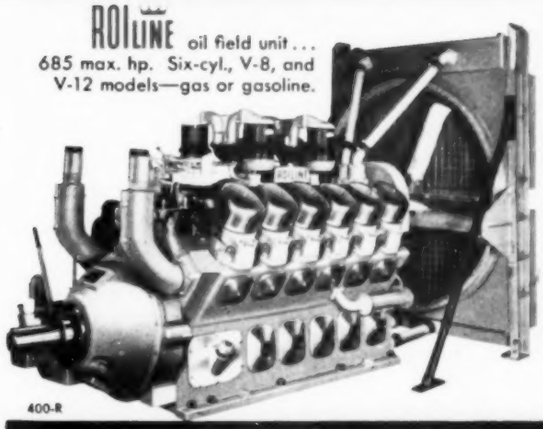
dominant in the industry for over 35 years



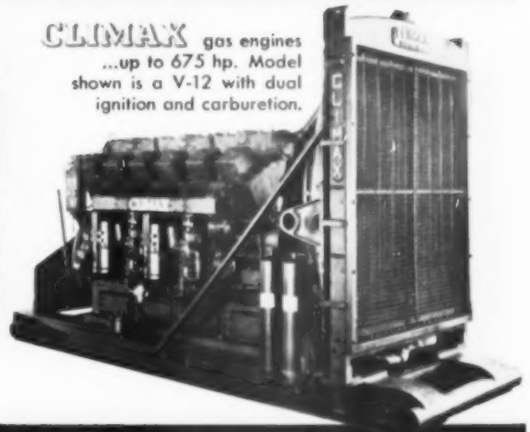
Waukesha MOTOR 12-cyl., 5788 cu. in., 1235 hp. turbocharged Diesel. Complete line ranges from 10 hp. for use with all standard fuels. Enginators (engine-generator sets) to 800 KW.

Since they first entered the oil fields, back in 1922, Waukesha engines have earned an enviable reputation for reliability and long, useful service. Now . . . long famous for its wide range of models, Waukesha's recent acquisition of the well-known Climax and ROILINE (formerly LeRoi) oil industry engines makes available a variety of sizes unmatched by any other engine builder—complete coverage to over 1200 horsepower, for use with all standard fuels.

ROILINE oil field unit . . . 685 max. hp. Six-cyl., V-8, and V-12 models—gas or gasoline.



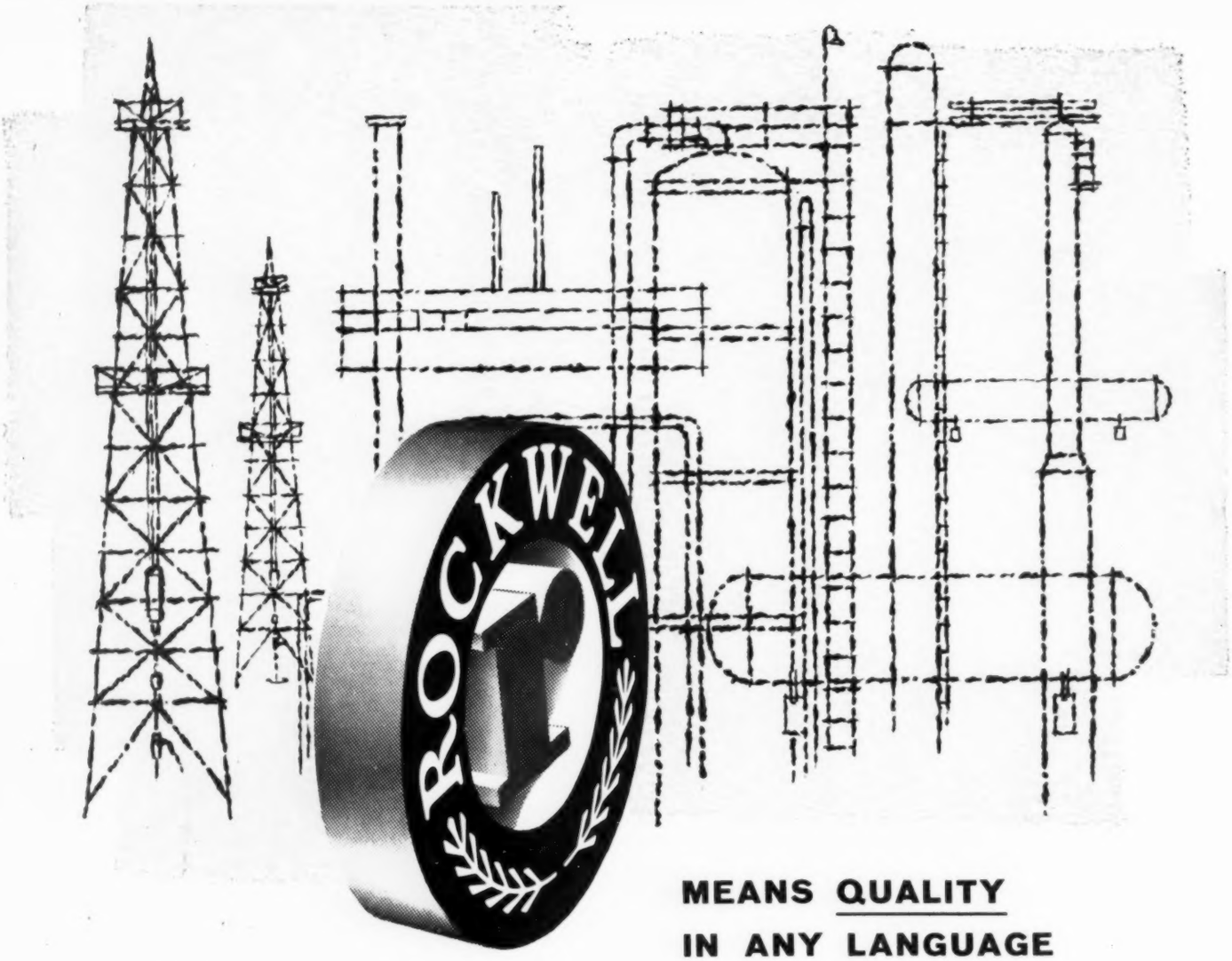
CLIMAX gas engines ...up to 675 hp. Model shown is a V-12 with dual ignition and carburetion.



400-R

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN • NEW YORK • TULSA • LOS ANGELES

Factories at Waukesha, Wisconsin and Clinton, Iowa



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WHEREVER OIL AND NATURAL GAS ARE PRODUCED, TRANSPORTED, PROCESSED AND MARKETED, YOU'LL MOST OFTEN FIND ROCKWELL MEASUREMENT AND CONTROL PRODUCTS. IN THE PAST HALF CENTURY, ROCKWELL HAS BECOME ANOTHER WORD FOR QUALITY WHEREVER VALVES, LIQUID METERS, GAS METERS AND PRESSURE REGULATORS PLAY VITAL ROLES IN PRECISE, ECONOMICAL OPERATIONS.

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FOR THE OIL AND GAS INDUSTRIES

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ROCKWELL

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for temporary service lines

Records show 1 mile of $2\frac{1}{2}$" aluminum oil country pipe unloaded, strung and coupled by 3 men in $1\frac{1}{2}$ hours! It strings 10 times faster than equivalent steel pipe because it's flexible and weighs $\frac{1}{3}$ as much. Reynolds Aluminum Oil Country Pipe takes a variety of standard couplings, is strong, resists corrosion, and never rusts. Available for fast delivery from Reynolds Oil Country Pipe Distributors at most oil field supply stores. For details write direct to Reynolds Metals Company, P. O. Box 2346-WP, Richmond 18, Virginia, or International Sales, 19 East 47th Street, New York 17, N.Y.

REYNOLDS ALUMINUM

VENEZUELA

Creole's Newest Supertanker

The new 46,550-ton Creole supertanker "Esso Maracaibo" entered Maracaibo harbor in ballast during its maiden trip from Innoshima, Japan where the ship was built. The "Esso Maracaibo" is the first of four identical supertankers ordered by Creole to replace its shallow-bottomed tankers. With the dredging of the channel into Maracaibo Lake, Creole intends to use exclusively deep draft supertankers with a combined tonnage of 200,000. At the end of 1957, Venezuela's total tanker capacity was of 216,000 tons. Other Creole supertankers also under construction in Japan are the "Esso Caracas," "Esso Amuay" and "Esso Caripito."

Labor's Oil Contracts

Every four years since 1946, Venezuelan oil workers have gotten together with the oil companies to discuss a collective labor contract. The last contract, signed in 1955, was rather mild. It called for a 10% salary and wage increase, plus small improvements in the fringe benefits program.

At that time, the government of General Marcos Perez Jimenez exercised strict control over oil workers, who were principally members of the outlawed opposition party, and their demands were toned down to a minimum. With the overthrowing of the régime in January 1958, oil unions became stronger, and union leaders began preparing their demands for the next collective contract, to be signed in 1959.

First move was to associate in a single organization under the name of Federation of Oil Workers (Fedepetrol) to which they delegated the power of discussing the contracts. The next was to hire professional economists and top lawyers of different political views, including Communist, to analyze the profits of the companies, the needs of the workers, and how much could be asked of the companies. Delegations were sent to the United States to study the standard of living and wages of the American oil workers. That information was compiled and, with the demands of member unions of Fedepetrol, made into a list of 165 demands, the last of which allows the workers to determine the duration of the contract if approved.

First reaction of the companies to the workers' demands was alarm. Officials of the top three companies operating in Venezuela (who declined to be quoted) termed the demands "excessive" and "outrageous" and considered them so "out of proportion" that they saw no possibility of agreement unless the demands were drastically cut down.

The companies cited various reasons for their inability to meet the workers conditions: (1) The Venezuelan tax law enacted late last year, which hit the oil companies hard; (2) The world surplus of producing capacity and oil stocks which have driven prices down; and (3) higher operating costs. Total cost of the proposed contract was considered by the companies to be some US $350 million. The unions place the figure closer to $200 million.

The Venezuelan government, which under the recent tax modification receives 60% of the net profits of the industry, views the contract with concern, since a possible strike would upset the nation's already burdened economy which depends almost entirely on oil income.

Another cause for government worry is the fact that if higher wages were granted to oil workers (present average 8 dollars per day) the gap would widen between their salaries and those of the common worker who makes less than half of the oil workers wages.

Fedepetrol officials have repeatedly stated that they will not back down since their demands are patterned after those of American oil workers. Their chief claim is that the parent companies of the Venezuelan subsidiaries pay their workers three times as much for the same jobs, which nevertheless do not produce as much profits to the companies as Venezuelan workers because of natural conditions.

Another of the union's demands is the total elimination of the oil contractors. They base their request on unemployment in the oil fields, due to contractors who hire and fire depending on the size and frequency of the contracts. This practice has created labor instability and made intervention by the executive government necessary to halt a strike. The government's opinion on this point is more conservative. They limit their approval to the eliminaton of those contractors who cannot guarantee job stablity to their workers. The workers have stated that they will agree to this, provided that the companies bond those remaining contractors and guarantee the contractors' obligations with the workers.

That, at present, is the picture of oil industry labor in Venezuela. The companies have formed a group named "Chamber of the Petroleum Industry" which they hope will be their instrument to make an appeal for help. The government is being carefully observant of any new developments which could place Venezuelan oil in an unfavorable position in the international market due to higher costs, but they appear confident that a solution will be found before a strike is called and they enjoy the backing of public opinion.

Loses Oil Sales to Brazil

An old customer of Venezuelan oil has recently signed an agreement with Brazil to buy their supply from that country. Uruguay's first purchase from Brazil started with 160,000 tons of fuel oil, which they can pay with their currency, instead of with US dollars.

National Energy Council Formed

The government has recently formed a National Energy Council to supervise and regulate the gas, oil and hydroelectrical energy production. The new council is formed from industry, commerce and government men, and will draft rules and standards for the production and use of the energy in Venezuela.

VENEZUELAN PETROLEUM STATISTICS—JANUARY THROUGH JULY
(Thousands of Barrels Daily)

	1959	1958	% Change
Production:			
Crude	2,821	2,524	+11.7
Natural Gasoline	3	3	—
TOTAL	2,824	2,527	+11.7
Refining	817	711	+14.9
of Products:			
Internal Consumption of Products:			
Industry & Domestic Use	75	68	+10.3
Oil Industry	12	11	+ 9.0
Delivered to Ships	51	52	— 1.9
TOTAL	138	131	+ 5.3
Exports:			
Crude	2,028	1,831	+10.8
Products	564	538	+ 4.8
TOTAL	2,592	2,369	+ 9.4

Source: Ministerio de Minas e Hidrocarburos.

Petrolia Company Comes Back

The Venezuelan government will put back into production the first natural oil concession granted to private interests, back in 1878. The natural surface deposit was discovered in the Andean region in San Cristobal, following an earthquake in nearby Cucuta, Colombia. Three years later, the government granted a concession to the "Compañia Aceitera Petrolia" formed by Venezuelan businessmen. The company operated without much financial success until 1934 when the concession was sold to Cia. Shell Venezuela. Repeated efforts of Shell company failed to bring about a large commercial operation in the area, and the concession was closed at a substantial financial loss. Last year Shell surrendered the concession, and the government now plans to put the Petrolia company back into production as a national symbol of the beginning of the oil industry in this country.

Petrochemical Sales

The government's Instituto Venezolano de Petroquimica has announced that Colombia and Ecuador have signed special agreements to buy from Venezuela some 30,000 tons each per year of petrochemical products. Payment will be in dollars.

Maracaibo Oil Find

Phillips Petroleum Co. has completed another flowing oil well on Lot 17 in Lake Maracaibo, Venezuela. The well, LPC-12-11, flowed 4,896 barrels of 34° gravity oil daily through a thick section of Eocene pay sand. Lot 17 is now producing approximately 45,000 barrels of oil per day from seven wells. Phillips is the operator of Lot 17 for a group composed of itself, Sunray Mid-Continent Oil Co., Ashland Oil and Refining Co., Western Natural Gas Co., El Paso Natural Gas Products Co., Kerr-McGee Oil Industries, Inc., and Venezuelan Pacific Petroleums, Ltd.

First Well Off Multiple Platform

Continental Oil Co. has begun drilling the first well off a multiple platform in the Gulf of Paria. The well, "Posa 112-A 2," is being drilled from a 100 x 112 ft. platform, 50 ft. above high tide level.

Shell Closes Oil Field

Shell of Venezuela has closed down the Orocual field in Monagas State after failure to make the operation pay for itself in several years. The concession has been placed in trust with Creole Petroleum Corp. which operates a successful concession nearby.

New Depth Record

A new depth record for Venezuela has been established by Creole Petroleum Corp. in Maracaibo Lake, when well A-139-1 went to a total depth of 16,051 ft. The former Venezuelan record was held by Mene Grande's 80-Z-1X well in Ceuta field with a total depth of 15,995 ft.

Two More Supertankers

Shell's new 33,000 ton supertanker "Shell Aramare" has been launched at the Fairfield Yards in Glasgow, Scotland. This is one of twin deep-draft supertankers which the company has ordered following dredging of the channel into Maracaibo Lake. Formerly, only very shallow draft tankers could enter the Lake.

The "Shell Aramare" will be manned by an all Venezuelan crew and has an approximate cost of $7 million. Delivery is expected in the early part of 1960.

New Mobil Gas Plant

The Mobil Co. of Venezuela has recently completed plans for the building of a gas compression plant in the Campo Mata field. The new plant will produce 150,000,000 cf of gas per day from locations L-1, L-2 and M-1. The plant will also aid in the recovery of additional oil. A gas pipeline is presently under construction for transporting some of the gas 20 miles away to other industrial installations.

Price Increase in Refined Products

On September 18, Sinclair, Creole and Shell companies published new prices for their refined products, including increases in their kerosene, No. 2 fuel oil, diesel, and heavy fuel oil. Increases by Shell of Venezuela amount to $0.25 per gallon on kerosene, fuel No. 2 and the three types of diesel oil. Creole Pet. Corp. increased its fuel No. 2 and diesel oil by $0.375 per gallon, and $0.13 and $0.14 for diesel industrial and marine fuel respectively. Sinclair prices by $0.375 for diesel with index 48-52. These prices follow changes announced for the Gulf of Mexico on September 15, however Creole and Sinclair prices were ⅛ of a cent higher than the Gulf of Mexico, whereupon the latter, rose by ⅛ of a cent.

Oil Production Up

Oil production during the first six months of 1959 increased 13.5% compared with the same period last year. Creole, Shell and Mene Grande produced 83.6% of total Venezuelan production. In the same period in 1958, those three companies produced 82.5% of the total. Shell in the first half of 1959 increased its production by 29% and Creole by 13.5%. San Jacinto, Venezuelan Sun and Superior Oil companies showed a combined 310% (sic) increase over their production during the first half of 1958.

Betancourt Halts Strike

Some 450 Richmond Exploration Co. workers were ordered back to work by a presidential decree following a 24-hour strike due to a disagreement over hiring procedures.

The President, on ordering them back to work, said: "The oil industry is the backbone of the nation's economy, and we can not afford the luxrury of an oil strike."

The decree ordered the formation of an arbitration committee integrated by labor, management and government members, which the workers have accepted under protest. The decree did not extend to 150 Halliburton Service Co. workers, also on strike in the East for similar reasons.

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The river bank once marked the boundary of this boy's life. But soon this bridge will open a new world to him. He'll meet new people, new ideas—and new opportunities.

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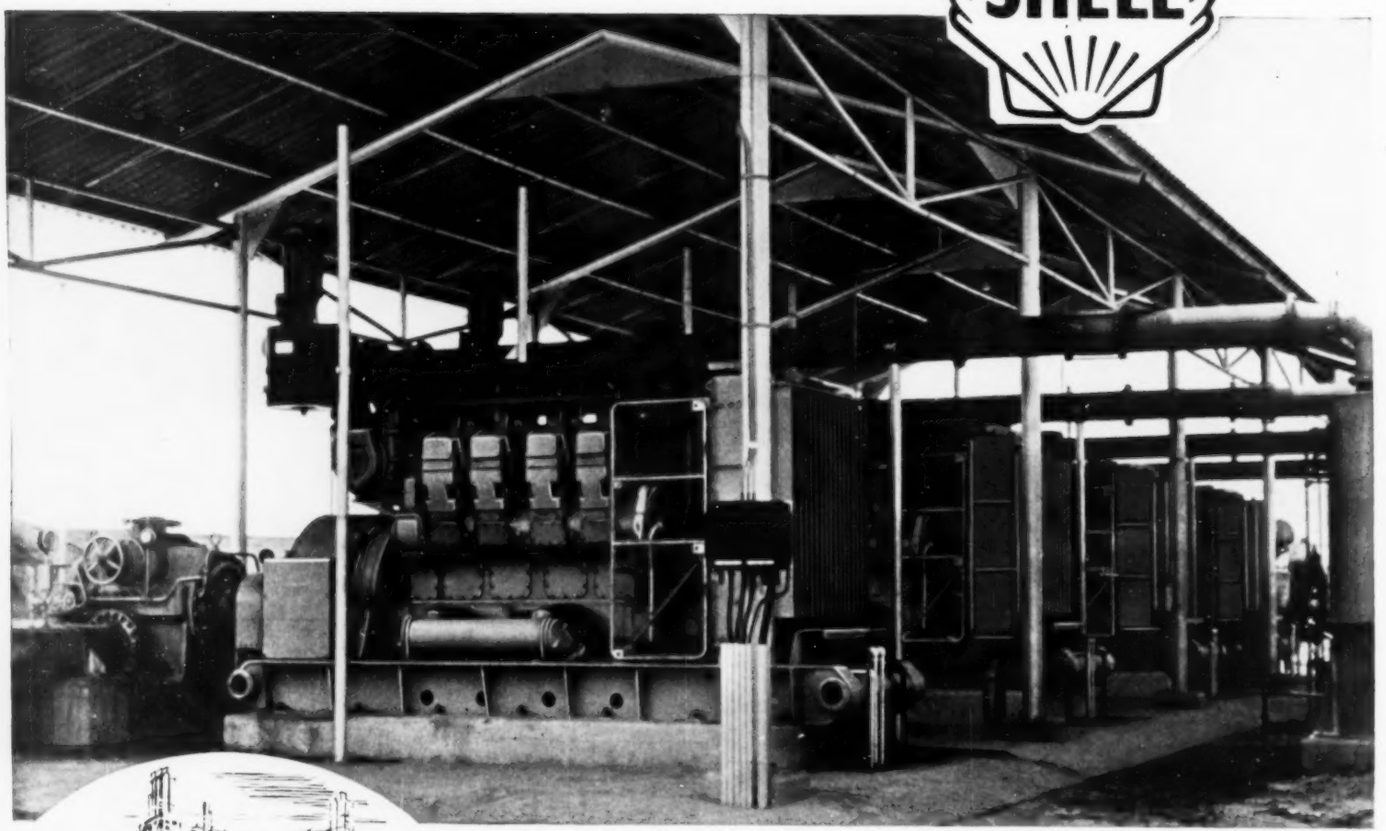

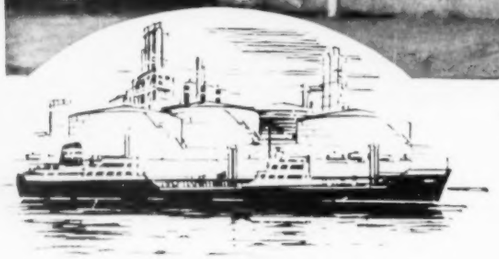

Four 'ENGLISH ELECTRIC' 8SV diesel engine package sets are on duty at the Puerto Miranda loading terminal of Cia. Shell de Venezuela Ltd. These sets, each with a continuous site output of 655 b.h.p. at 720 r.p.m., drive positive displacement pumps through hydraulic couplings to deliver the crude oil to tankers. The speed of the pumps can be varied between 290 and 720 r.p.m.

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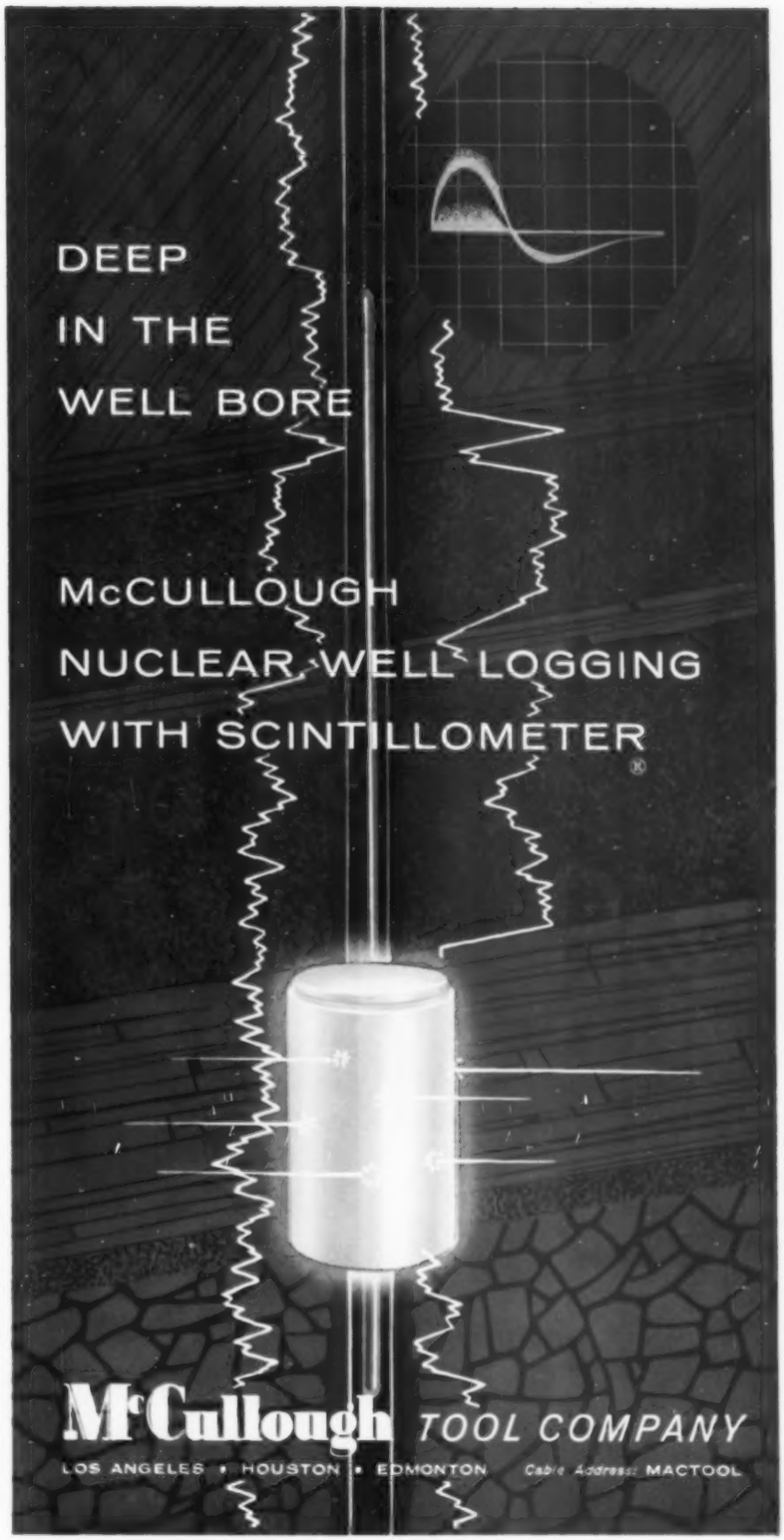

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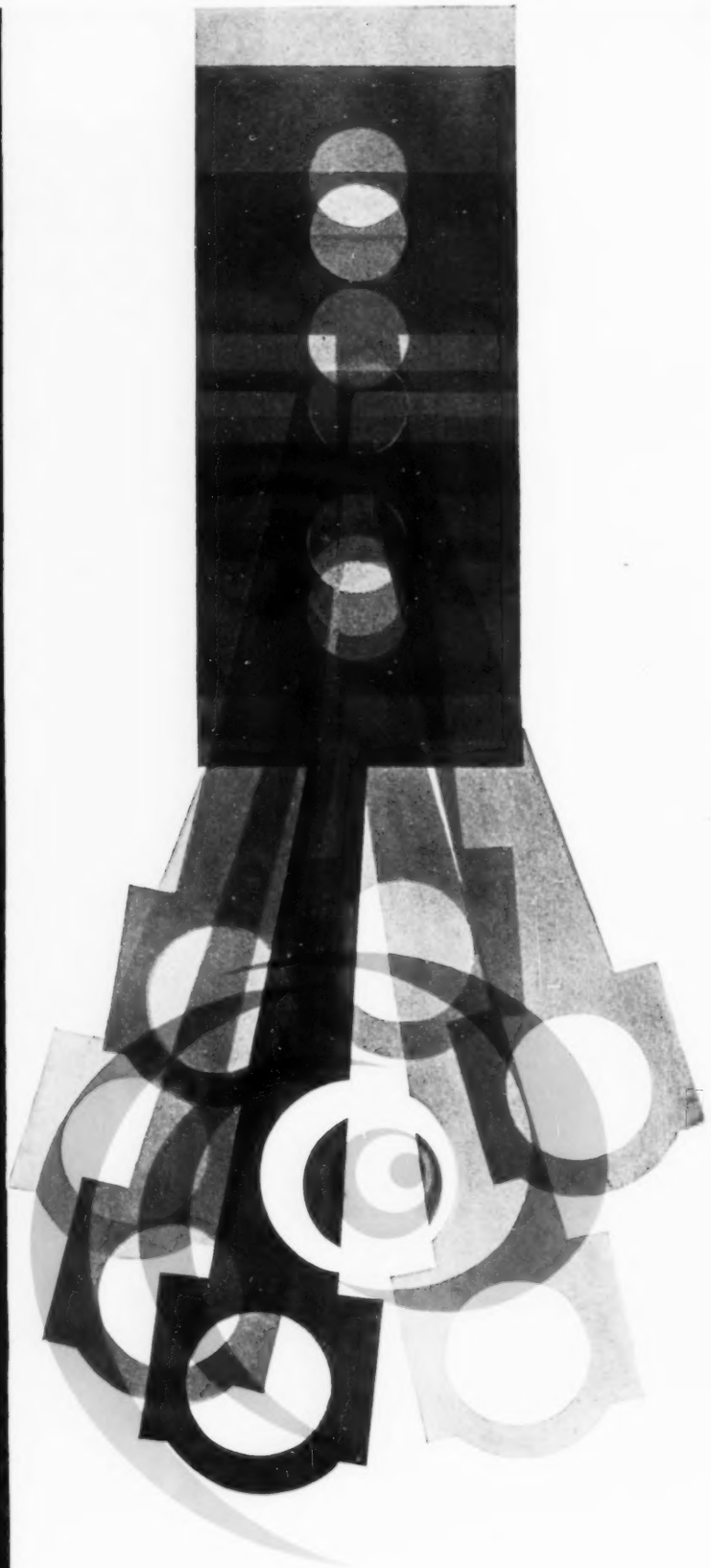
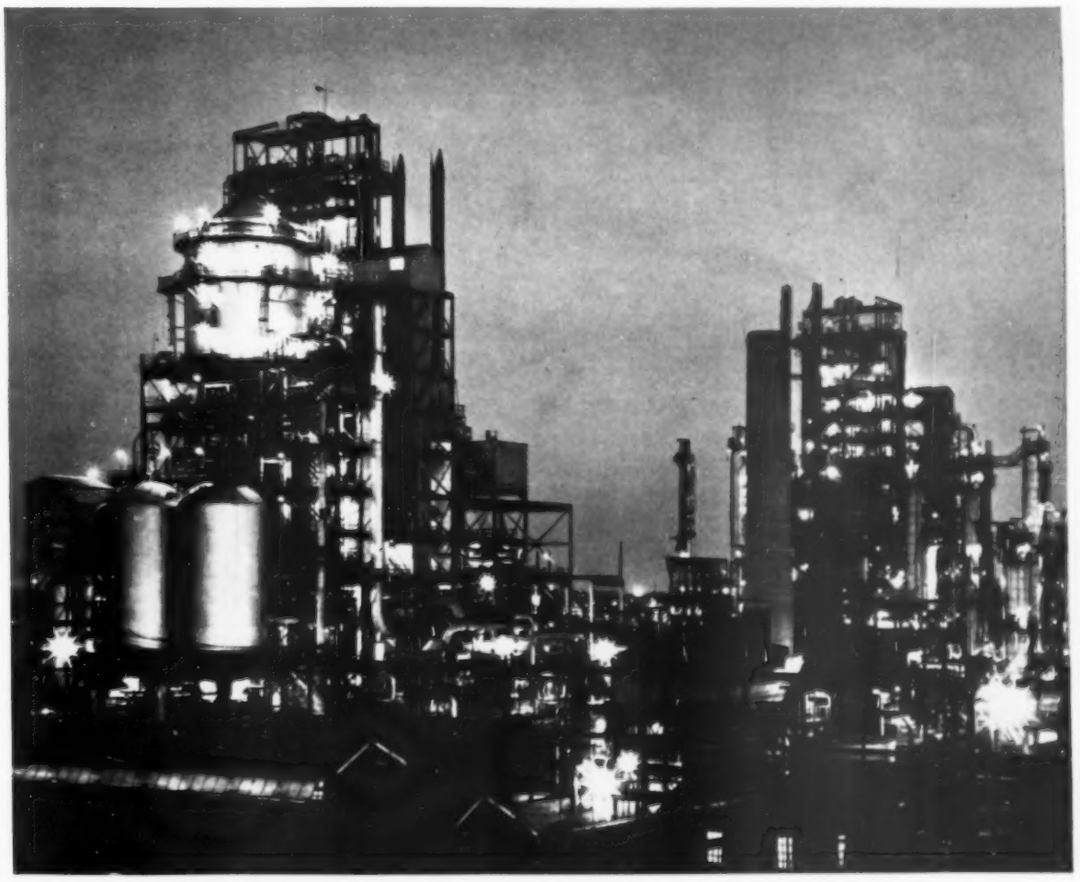


NEWS ON TEXACO PROGRESS

Two views of progress . . . 57 years apart

YESTERDAY. Texaco's first refinery at Port Arthur came into being in 1902 to turn the black crude oil — newly discovered in quantity — into useful products for mankind. Produced in simple stills, the first products were kerosine, naphtha, asphalt and primitive lubricants.



TODAY. At Port Arthur, and at 11 other major Texaco refineries in the United States, ultra-modern chemical wizardry uses many methods to produce constantly improved gasolines, perfected lubricants, and a myriad of other petroleum products. Because these products are so vastly improved, you can drive a more powerful car — jet planes can fly faster and farther — industry can operate more efficiently. And because it has constantly planned ahead, Texaco's growth has been continuous.

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ENGLAND—Steele Griffiths & Co., Ltd., London S. E. 5
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FRANCE—Hotchkiss-Brandt, S.A., Saint Denis (Seine), Paris
GREECE—Titan Motor & Tire Trading Co. Ltd., Athens
ICELAND—Egill Vilhjalmsson H.F., Reykjavik
IRELAND—Motors Distributors Ltd., Dublin
ITALY—Industrial Products Agencies A. R. I., Rome
LUXEMBOURG—Garage Albert Lutgen, Luxembourg Gare
MALTA—Mizzi Brothers, Valletta
NETHERLANDS, THE—Kemperen Van Twist Diesel N. V., Dordrecht
NORWAY—Norsk Scania-Vabis A. S., Oslo
PORTUGAL—Importacao e Comercio de Automoveis Ltda., I.C.A.L., Lisbon
SAINT PIERRE MIQUELON—George Pannier
SPAIN—Autohaus, S.A., Madrid
SWEDEN—A.B. Scania-Vabis, Sodertalje
SWITZERLAND—Fratelli Ambrosoli, Zurich 1
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BELGIAN CONGO—Matermaco Congo, Leopoldville, Matermaco Congo, Elisabethville, Soumotor, Ruwasu
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NIGERIA—Dizengoff West Africa Ltd., Accra
PORTUGUESE EAST AFRICA—Ronil Limitada, Lourenco Marques
PORTUGUESE WEST AFRICA—Casa Americana Comercial, Luanda, Angola
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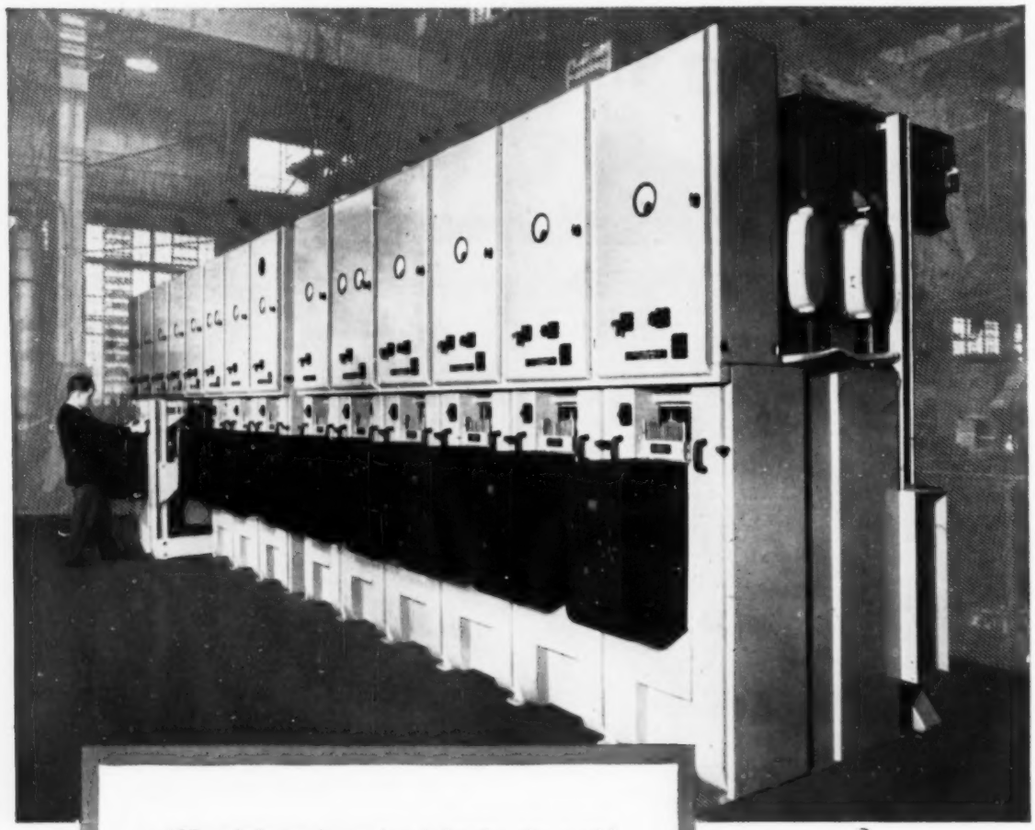

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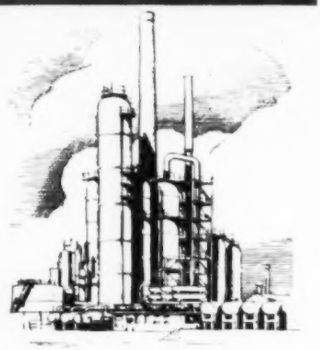

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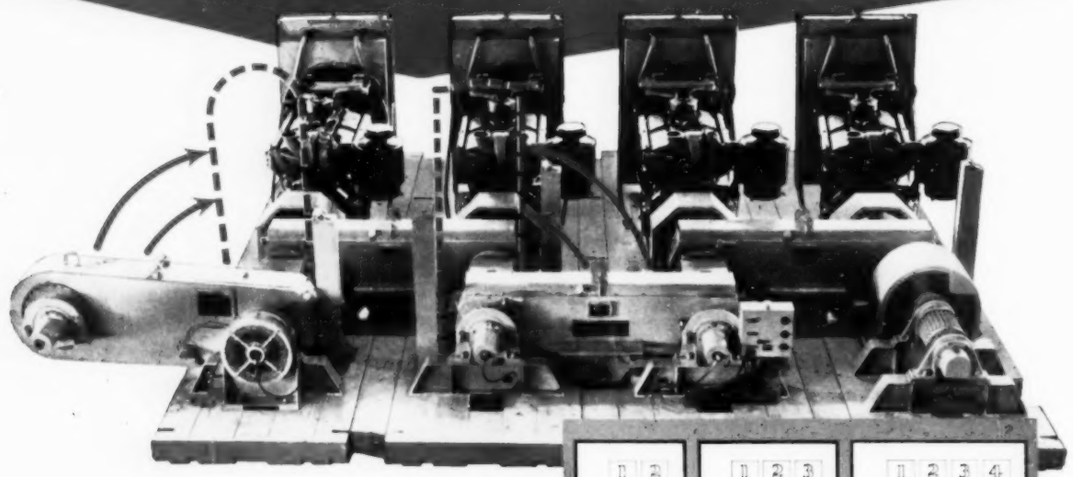
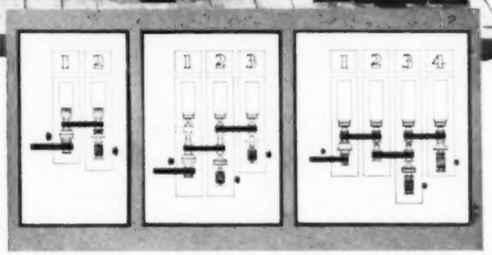


*PATENTED



2AE 3AE 4AE

an exclusive feature on
MID-CONTINENT AE RIG DRIVES

The Mid-Continent AE Rig Drive is a development of the Swinging Compound, a patented Mid-Continent feature. Swinging Compounds simplify the addition of engines, and makes possible moves without opening compound cases, draining oil, or "breaking" chains. Simply by pivoting Swinging Compounds to a vertical locked position, the units are ready to move to the next location. Designed for two, three, or four engines totaling 800 to 2400 horsepower, all compound case assemblies are identical for any combination. There is an AE Rig Drive to match your drilling requirements. Contact your Mid-Continent representative for complete information.

Scheduled for shipment to Argentina, this rig is equipped with a Mid-Continent 3AE Rig Drive including Swinging Final Drive, and Swinging Pump Drives for the maximum in flexibility and quick rig-up.

RD1-9

MID-CONTINENT SUPPLY CO.

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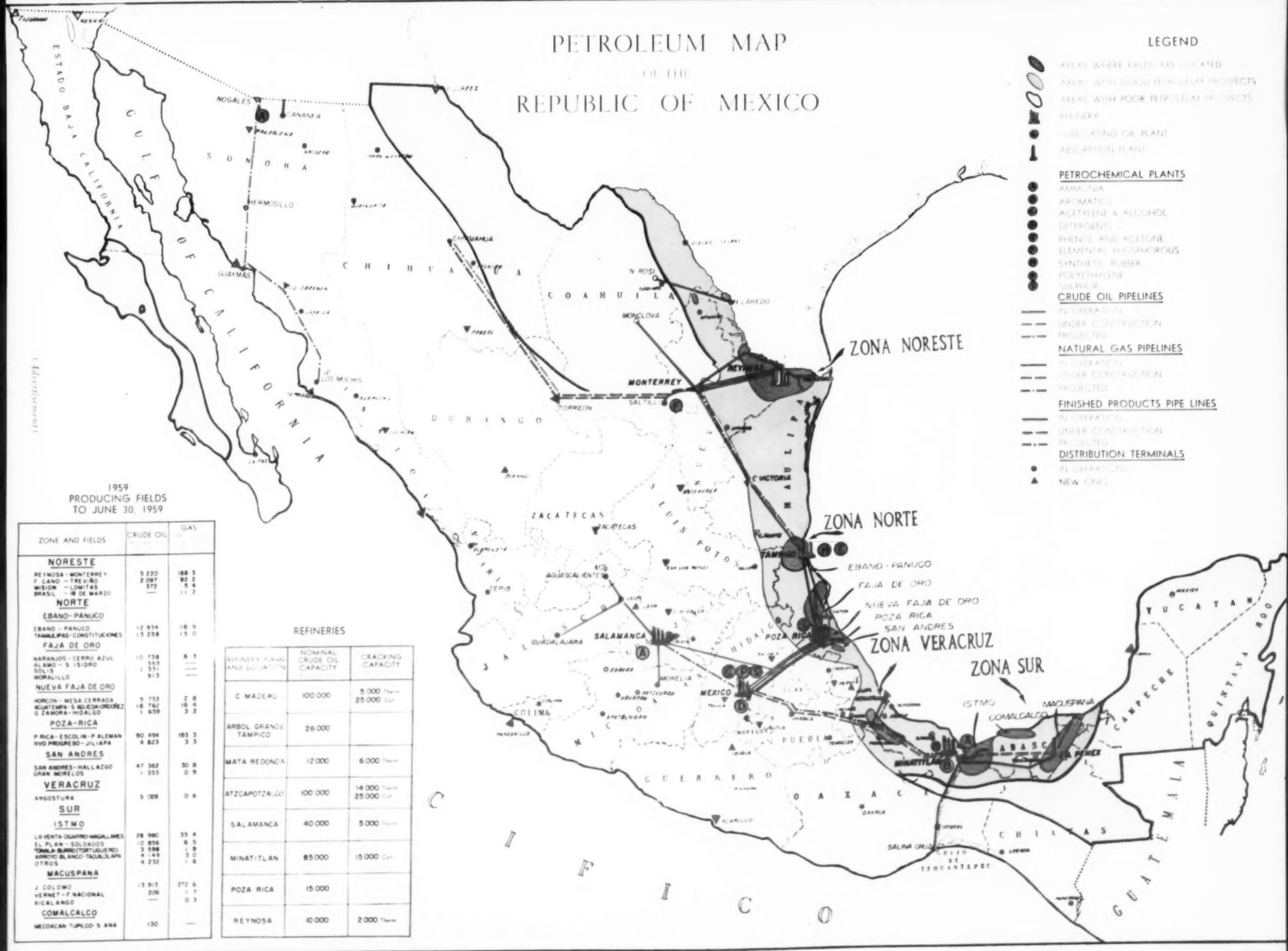
THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

PETROLEUM MAP
OF THE
REPUBLIC OF MEXICO



LEGEND

- AREAS WHERE FIELDS ARE LOCATED
- AREAS WITH GOOD PETROLEUM PROSPECTS
- AREAS WITH POOR PETROLEUM PROSPECTS
- REFINERY
- LUBRICATING OIL PLANT
- ABSORPTION PLANT

PETROCHEMICAL PLANTS

- AMMONIA
- AROMATICS
- ACETYLENE & ALCOHOL
- DETERGENTS
- PHENOL AND ACETONE
- ELEMENTAL PHOSPHOROUS
- SYNTHETIC RUBBER
- POLYETHYLENE
- SULPHUR

CRUDE OIL PIPELINES

- IN OPERATION
- UNDER CONSTRUCTION
- PROJECTED

NATURAL GAS PIPELINES

- IN OPERATION
- UNDER CONSTRUCTION
- PROJECTED

FINISHED PRODUCTS PIPE LINES

- IN OPERATION
- UNDER CONSTRUCTION
- PROJECTED

DISTRIBUTION TERMINALS

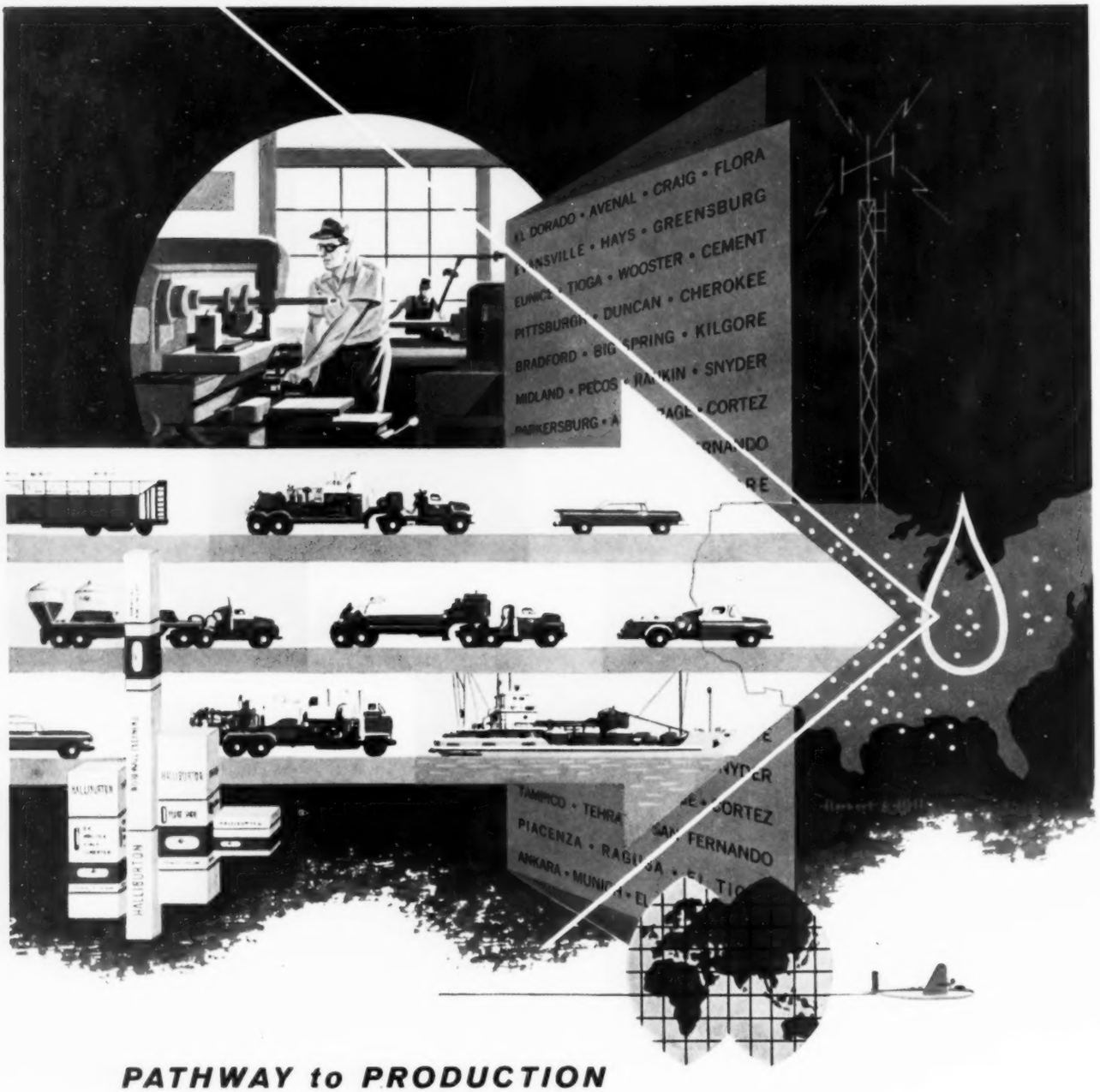
- IN OPERATION
- NEW ONES

1959
PRODUCING FIELDS
TO JUNE 30, 1959

ZONE AND FIELDS	CRUDE OIL	GAS
NORESTE		
REYNOSA - MONTERREY	3 220	188 3
F. CANO - TREVIÑO	2 097	92 2
MISION - LOMITAS	372	5 4
BRASIL - 18 DE MARZO	—	11 2
NORTE		
EBANO-PANUCO		
EBANO - PANUCO	12 934	18 9
TAMAULIPAS - CONSTITUCIONES	13 258	15 0
FAJA DE ORO		
NARANJOS - CERRO AZUL	10 738	6 3
ALAMO - S. ISIDRO	365	—
SOLIS	1 331	—
MORALILLO	913	—
NUEVA FAJA DE ORO		
HORCON - MESA CERRADA	5 753	2 8
ACUATEMPA - S. AGUEDA - ORDUÑEZ	18 764	16 4
G. ZAMORA - HIDALGO	1 659	3 2
POZA-RICA		
P. RICA - ESCOLIN - P. ALEMAN	90 494	193 3
NVO. PROGRESO - JILIAPA	4 823	3 3
SAN ANDRES		
SAN ANDRES - HALLAZGO	47 362	30 8
GRAN MORELOS	1 353	0 9
VERACRUZ		
ANGOSTURA	5 089	0 6
SUR		
ISTMO		
LA VENTA - OGARRIO - MAGALLANES	28 980	35 4
EL PLAN - SOLDADOS	10 856	6 5
TONALA - BURRO (TORTUGUERO)	3 598	1 9
ARROYO BLANCO - TACOLULAPA	4 149	3 0
OTROS	4 232	1 6
MACUSPANA		
J. COLOMO	13 913	272 6
VERNET - F. NACIONAL	206	1 7
XICALANGO	—	0 3
COMALCALCO		
MECOACAN - TUPILCO - S. ANA	130	—

REFINERIES

REFINERY NAME AND LOCATION	NOMINAL CRUDE OIL CAPACITY	CRACKING CAPACITY
C. MADERO	100 000	5 000 Therm 25 000 Cat
ARBOL GRANDE TAMPICO	26 000	
MATA REDONDA	12 000	6 000 Therm
ATZCAPOTZALCO	100 000	14 000 Therm 25 000 Cat
SALAMANCA	40 000	5 000 Therm
MINATITLAN	85 000	15 000 Cat
POZA RICA	15 000	
REYNOSA	10 000	2 000 Therm



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Distribution is accomplished through an integrated plan that makes available your requirements from whatever geographic area they happen to be, and . . . in any type of weather.

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Experienced operators can continue to be confident that Halliburton makes possible the industry's best "pathway to production."

HALLIBURTON OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA

by H. S. M. Burns
Chairman, American Petroleum Institute

Don't apologize for profits

Do oil companies make too much money? If those who think so knew a little more about the history of prices and the history of costs, they might not be so sure.

The fact is that the oil industry, or more correctly the people who invest in it are not living high on the hog. They are a little lower on the hog than other investors. Domestic oil industry profits stated in terms of percentage return on the stockholders' investment have consistently run behind the average for all manufacturing industries. For example, the average rate of return on the stockholders' investment in the 16 largest domestic oil companies over the last five years was 9.7%, compared with 10.9% for all manufacturing industries.

Does this mean oil company profits are too high? Not in my book.

Therefore, if we find our earnings in 1959 are higher than last year, as we certainly hope they will be, let's not hang our heads and announce the figures with any kind of an apology.

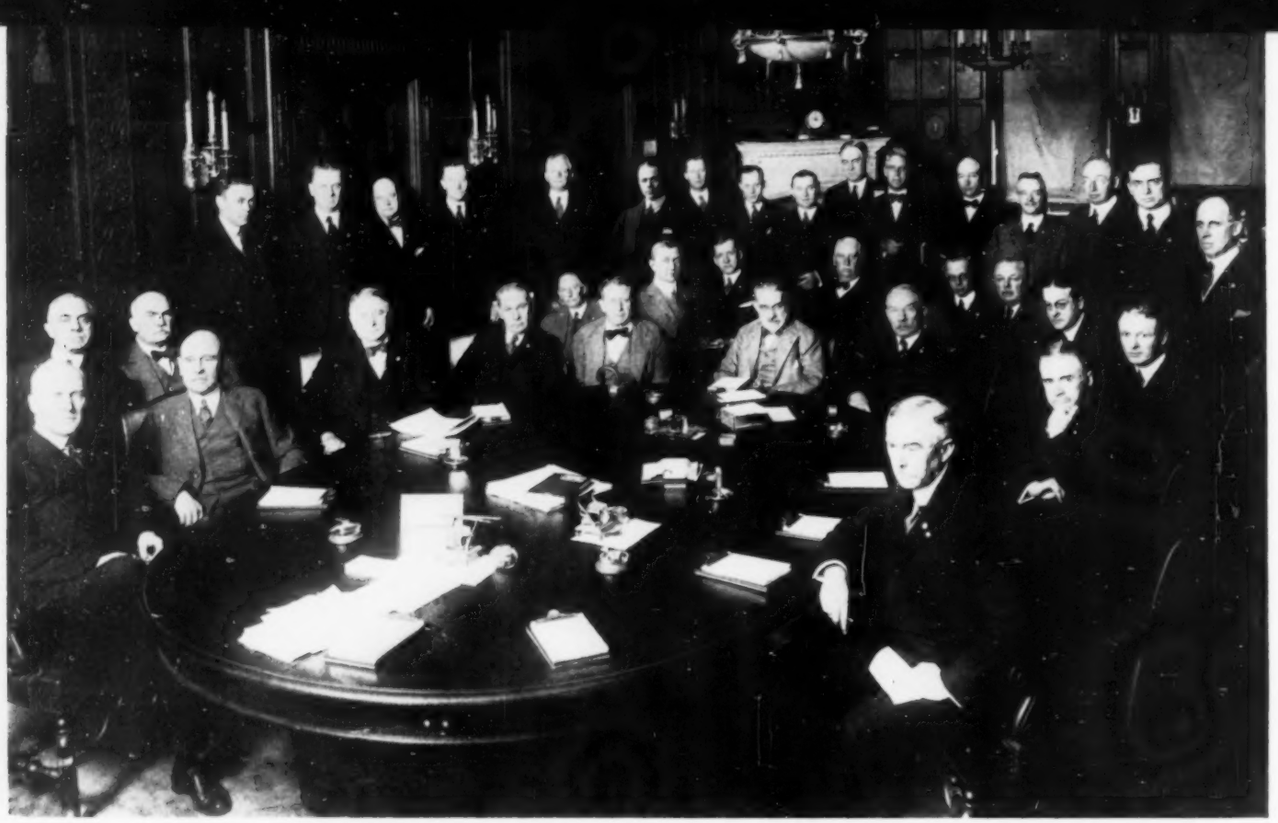
The word "profit" has been too much maligned of late. It is time it got back in favor. This industry of ours has served the nation well precisely because it has been able to make a profit. We need to remind ourselves—and everyone else we can reach—that reward for accomplishment is a basic precept of a free society. The strides that have been made by American business in the twentieth century are due principally to the fact that there is a reward for effort in the form of profit. Of all the motivations to which humans (and corporations) respond best, few have proved as powerful as the chance of financial gain.

This nation gets two thirds of its energy from petroleum and natural gas. The job of providing that much energy cannot be done by an industry that is financially sick or enfeebled. The industry called upon for such service can meet its obligation only if it stays strong enough to go on working to do its current job—and growing fast enough to meet the even greater demand that will be placed on it in the future.

This applies to the jobs of finding and producing and transporting crude oil and to manufacturing and distributing products. It applies to the costly and long-drawn-out task of doing the scientific research necessary to improve products and to develop new ones for needs which will arise in the future. And it applies to the industry's wish to continue playing its increasingly significant role as a good corporate citizen through support of education, health and other projects of benefit to the community at large.

In a free society, the strength of the whole must arise from the strength of all the parts. The surest evidence of strength in industry is its ability to serve the nation and to do it well enough to earn a fair reward from those whose needs are served.

This is what we mean by profit. That one word, more than any other, explains the industry's 100-year record of service to the nation and the world. That same word holds the key to progress for the future.



The National Petroleum War Service Committee—World War I

First row, seated, left to right: **A. C. Bedford,** *chairman of the committee, and chairman, board of directors, Standard Oil Co. of New Jersey;* **M. L. Requa,** *director, Oil Division, U. S. Fuel Administration;* **J. W. Van Dyke,** *president, The Atlantic Refining Co.;* **George S. Davison,** *president, Gulf Refining Co.;* **T. A. O'Donnell,** *director of production, Oil Division, U. S. Fuel Administration;* **H. L. Doherty,** *president, Cities Service Co.;* **E. W. Clark,** *president, Union Oil Co. of California;* **H. E. Felton,** *president, Union Tank Line; and* **R. D. Benson,** *president, Tide Water Oil Co.*

Second row, seated, left to right: **E. C. Lufkin,** *vice-chairman of the committee, and president, The Texas Co.;* **Martin Carey,** *general counsel, Standard Oil Co. of New York;* **Edward Prizer,** *president, Vacuum Oil Co.;* **Ivy Lee,** *director of publicity of the committee;* **Samuel Messer,** *president, Emlenton Refining Co.;* **J. C. Donnell,** *president, The Ohio Oil Co.;* **A. G. Maguire,** *director, jobbers and licenses, Oil Division, U. S. Fuel Administration;* **W. P. Cowan,** *former president, Standard Oil Co. (Indiana);* **H. M. Blackmer,** *president, Midwest Refining Co.;* **J. S. Cosden,** *president, Cosden and Co.*

Third row, standing, left to right: **W. C. Teagle,** *president, Standard Oil Co. of New Jersey;* **J. E. O'Neill,** *president, Prairie Oil and Gas Co.;* **H. F. Sinclair,** *president, Sinclair Oil and Refining Co.;* **J. H. Markham, Jr.,** *Tulsa, Okla. producer;* **George W. Crawford,** *president, Ohio Fuel Supply Co.;* **J. Howard Pew,** *president, Sun Oil Co.;* **C. C. Smith,** *assistant secretary and treasurer of the committee;* **J. A. Moffett,** *secretary of the committee;* **J. F. Guffey,** *president, Natural Gas Association of America;* **J. H. Barr,** *president, National Supply Co.;* **Frank Haskell,** *president, Mid-Continent Oil and Gas Association;* **W. S. Farish,** *president, Gulf Coast Oil Association;* **M. J. Byrne,** *president, Independent Oil Men's Association,* **J. A. Middleton,** *Oil Division, U. S. Fuel Administration;* **R. L. Welch,** *secretary and general counsel, Western Petroleum Refiners Association; and* **A. P. Coombs,** *president, Standard Oil Co. of Ohio. Photo by: Underwood & Underwood News-Photos, 3 West 40th Street, New York.*

Forty years of the API

This year marks the centennial of the petroleum industry in the United States and the 40th anniversary of the API. From its beginning just after the first World War, the API has grown to the industry's forum and most representative public body.

This year marks both the 100th anniversary of the American oil industry and the 40th anniversary of the American Petroleum Institute. Founded in 1919 as a voluntary, non-profit organization, the API was the first national oil trade association representative of the industry in its many divisions and branches. It has been functioning vigorously as a service organization for the petroleum industry and the nation ever since.

World War I brought the chief executives of the so-called majors and independents together for the first time under the auspices of the National Petroleum War Service Committee, the industry's liaison agency with the Federal Government during this period. Working together in a joint effort united by a common cause, the various industry groups met the emergency oil demands with notable success.

When the war ended, some forward-looking members of the NPWSC decided to form an organization that would operate as a large-scale educational center, information bureau, and technical standardization agency for individuals and companies active in all phases of the oil business.

It would cooperate with the government and with associations and companies of related industries such as steel, automobiles, and chemicals. Aside from administrative functions, all work of the API was to be done by volunteers.

T. A. O'Donnell, an independent oil producer from California, was elected presi-

dent, and Robert L. Welch, an Iowa lawyer, became the API's first secretary and general counsel. The two positions corresponded respectively to today's API positions of chairman and president.

No trade association could have been launched under finer auspices or with better objectives than was the API. From the outset it strove to provide a forum for oilmen, a place where mutual problems could be discussed in an atmosphere of respect and confidence.

Two proposals discussed and adopted by the Board that very first year have since proven of inestimable and lasting value. One proposal called for cooperative technical work with the automotive industry. Today this activity is carried out through the Coordinating Research Council, sponsored by the API and the Society of Automotive Engineers. The second proposal was that the Institute undertake the collection and prompt distribution throughout the industry of current production and refining statistics.

Over the years, API has initiated many other valuable services. In fact, there are few problems in the petroleum industry with which the Institute has not concerned itself during the past forty years. The solutions of these problems have meant tremendous savings to the industry and to the public.

As a result, API membership has grown to include more than 11,000 individuals and companies throughout the United States, Canada, and Mexico, with membership about equally divided between large and small businesses.

Obviously, it is out of the question for the Institute to act as official spokesman for all, or even a majority, of the myriad interests which make up the oil industry. What it does strive to do is to be *representative* of this vast and complex business. The fact that the Institute takes action on any matter only after it obtains virtually unanimous consent to such action from its interested members demonstrates its effort to represent the thinking of most oil men in the United States.

Whenever there is substantially unanimous agreement among members, the Institute can and does function in the broad field of national interest and concern. It does not concern itself with controversial or competitive matters, but rather with those things that are for the mutual good of the industry and those it serves. Here are the basic objectives of the API as set forth in its charter:

"To afford a means of cooperation with the government in all matters of national concern.

"To foster foreign and domestic trade in American petroleum products.

"To promote, in general, the interests of the petroleum industry in all of its branches.

"To promote the mutual improvement of its members, and the study of the arts and sciences connected with the petroleum industry."

Working toward these objectives, a board of directors determines and guides API policy. Directors are elected by the membership for staggered two-year terms. A majority of nominations to the board are made at a meeting of several hundred members of a board of councillors. The board itself nominates some directors. At the Institute's annual meeting members can nominate directors and vote for or against the nominees.

Both large and small companies are represented on the board. It is composed of 121 elected members, and 10 members ex officio who are presidents of various oil trade associations. The board chooses officers of the Institute and names 30 of its members to serve with these officers as an executive committee.

By far the lion's share of Institute work is conducted through hundreds of working committees and subcommittees whose membership totals several thousand. In general, no activity is assigned to a working or functional committee unless that work has been proposed and urged upon the Institute by a group of oil men interested in the problem, and unless substantial sentiment for the activity has developed within the industry.

The Institute's annual meeting provides a major forum of discussion of work done by these committees and subcommittees. This meeting is attended by more than 6,000 oilmen and other interested persons. Papers on topics of general interest are presented and discussed at general sessions by speakers of national reputation from within and without the industry.

Supplementing the general sessions are group meetings for presentation of papers on technical and scientific subjects related to oil's operating problems. Work in progress is reviewed and evaluated at scores of meetings, and programs are planned for the coming year.

Frank M. Porter, elected president of the American Petroleum Institute since April 3, 1950.

T. A. O'Donnell, the API's first president.

H. S. M. Burns, serving as chairman of the American Petroleum Institute.

R. L. Welch, who served the Institute as secretary and general counsel from 1919 to 1929.

The Institute's various divisions and departments also may hold mid-year meetings, primarily for consideration of technical problems related to their fields.

There are five divisions within the API Production, Refining, Marketing, Transportation, and Finance and Accounting.

Production is concerned with the technology, equipment, and field practices used in drilling and producing operations.

Refining handles problems related to analytical and automotive research, disposal of refinery wastes, petroluem product improvement, personnel training, and development of better equipment.

Marketing supplies a national forum for petroleum distributors and marketers.

Transportation deals with movements of crude oil and products by rail, water, highway, and pipeline.

Finance and Accounting provides a forum for discussion of financial and accounting techniques, and renders services in those fields to the four other divisions of the American Petroleum Institute.

Staff members in each division work in co-operation with their respective committees of industry representatives. In addition to the five divisions, the API has two service departments: statistics and technical services.

The department of statistics, one of the oldest units of the Institute, is concerned with the collection and distribution of current data on crude oil production, refinery capacity, runs-to-stills, reports on LPGas production and inventories, and similar statistical surveys.

The department of technical services assembles and publishes information on fundamental oil research, accident prevention, fire protection, precautionary labels for petroleum products and other related safety subjects.

A continuing, long-range program of fundamental research, supervised by API's research committee, is another important and valuable Institute project. Among other things, this program seeks to obtain, for the information of the industry, a new knowledge of basic facts related to the occurrence, recovery and composition of petroleum. Another area of work, begun in 1954, deals with investigation of the fundamentals of weather forecasting.

More than nine million dollars have been spent and more than 100 projects and grants-in-aid programs undertaken since API's fundamental research program was started in 1926. The basic purpose of this program was aptly summarized by Monroe E. Spaght, an oil company executive and a member of the API board, in an address delivered at the Institute's 37th Annual Meeting in 1957.

"An industry such as ours," he declared, "could rely on universities or its own sporadic efforts to widen the knowledge base on which it can grow. But we as an industry have learned that our tremendous appetite for new knowledge demands that we shoulder, either directly or indirectly, the responsibility for providing our own . . . Its purpose (research) is to broaden our foundation of basic knowledge about the material we work with—nothing more. What we, as individual members serving individual companies, do with that information is up to us."

API research projects are of a basic nature and are intended to assist individuals and companies in developing new methods. In implementing this program, the committee sponsors numerous research projects at the nation's leading universities and cooperates with projects of Federal and private research agencies.

The API has many additional committees which are served by staff members. A partial listing of committees gives some indication of the scope and range of API work:

Medical Advisory, Accident Prevention, Fire, Agriculture, Evaporation Loss, Liquefied Petroleum Gas, National Electrical Code Coordination, Drilling and Production Practice, Refinery Equipment, Smoke and Fumes, Petroleum Products, Automotive Research, Personnel Training, Operations and Engineering, Marketing Research, Fuel Oil, Aviation Technical Service, Railroad Transportation—these are only a few of the Institute committees, each one manned by dedicated industry volunteers.

Still other committees deal with highways, oil history, asphalt, United Nations activities, pipelines, radio facilities and standardization of equipment.

This last-named project is one of API's most notable achievements. Before the advent of API standardization, chaos existed in the industry in such matters as interchangeability of threaded pipe, as well as in grades and quality of material.

Threaded connections for the same sizes of oil equipment often didn't fit if the parts came from different manufacturers—and sometimes didn't do so even if they came from the same manufacturer.

As a direct result of efforts by API's Central Committee on Standardization of Oil-Field Equipment during its first five years of existence, the number of sizes of cable-tool joints were cut from 300 to 14, sizes of derricks from 200 to 9, and pipe sizes from 200 to 95.

Today more than 900 manufacturers in the United States and overseas are licensed to stamp the API monogram on various types of oil equipment. Authority to use this official monogram means that the material was manufactured in accordance with rigid specifications of the Institute.

The standardization committee includes many major subcommittees, each responsible for specifications and recommended practices in such fields as cable-drilling equipment, belting, boilers, derricks and masts, tubular goods, oil well cement, wire rope, production equipment and storage tanks.

The standardization of oil field and other equipment by the API is estimated to save the world oil industry and its customers more than $15 million yearly.

Another significant Institute activity involves contact and cooperation with other organizations, particularly trade associations and technical societies.

Among such cooperating organizations are the American Society for Testing Materials; American Standards Association; American Society of Mechanical Engineers; Coordinating Research Council, Inc.; National Fire Protection Association; National Safety Council; Manufacturing Chemists' Association; Society of the Plastics Industry; as well as federal and state bureaus and agencies, and public officials.

One year ago, a new organization within the API—the Committee on Public Affairs—was created by combining two previous organizations, American Petroleum Industries Committee (APIC) and the Oil Information Committee (OIC). The new group, which began functioning in the fall of 1958, has the following objectives:

1. To stimulate the timely dissemination of information concerning the petroleum industry so that public opinion and decisions relating to it will be founded in fact.

2. To develop a climate in which a privately-managed and competitive petroleum industry can best serve the American people and strengthen the national economy.

3. To encourage acceptance by all those engaged in the petroleum industry of their responsibility to assist government at all levels in matters of public interest affecting the industry and its customers.

To assist the Committee on Public Affairs in carrying out these goals, a number of advisory committees have been established. These are composed of oil people with specialized knowledge and experience in the areas assigned.

The CPA promotes a comprehensive, widespread program of public relations and public education. It produces motion pictures, radio and television programs; prepares news releases, speeches, pamphlets and magazine articles; furnishes a wide variety of material for use by individual companies; and publishes much informational data including Petroleum Facts and Figures, the statistical bible of the industry.

These, then, are a few of the highlights of API's forty years of existence. It can readily be seen that the API is truly an industry-wide association. Moreover, its basic objectives have always been, and will continue to be, in the public interest. One example of this is that all findings of API's research program are dedicated to the public.

The accomplishments of the Institute are the result of the work of thousands of dedicated oil men and women and the oil companies who make up API's membership. Out of this cooperative experience has come an ever-growing sense of industry responsibility, a willingness among individual companies to share their working knowledge with other companies for the good of all. This, in turn, has done much to serve the cause of national and world progress. END

A reappraisal needed

by Harley C. Stevens

In the light of the growing world surplus of petroleum it is essential that the governments of producing nations as well as the international oil companies seek closer liaison and the establishment of realistic policies

DEVELOPMENTS DURING the past year in the international oil field make it plain that for a variety of reasons, there must be a major reassessment and re-evaluation of oil practices and policies, not only by the major international oil companies, but also by the producing countries as well. Perhaps the primary source of pressure for such a change arises from the fact that the world's oil productive potential (including Russian oil) for the first time considerably outruns not only the existing requirements but also, as well, the projected potential world demand for petroleum products for many years to come. As a result we see, for example, the rather extraordinary advocacy on the part of the Saudi Arabs, whose earlier aim has always been more and more production, of the adoption of a widespread policy of the prorationing of production along the lines of the conservation practices of the state of Texas—which are presumably designed to conserve oil for future generations as well as maintain the value of such resources in the international market. This, of course, is the primary aim of the major oil companies and their financial backers.

The difficulty in all this is that the past several years have seen the rise of the independent oil operators—who, having entered the foreign oil production field and having discovered oil in considerable quantity, are now faced with the problem of disposing of it. Since few of them have any foreign outlets, and the number of independent refiners who may freely purchase from them (at almost any price) is very limited, this presents a very serious problem, particularly as the cost of establishing their own outlets is, for all practical purposes, beyond their financial ability. This explains why several independent oil companies with recently discovered foreign oil reserves, having found it virtually impossible to dispose of their excess Venezuelan production in Europe (or in the U. S., due to mandatory import controls), have sold out their holdings to oil companies having established outlets.

As for those independent operators in Venezuela who remain, they may welcome the activities of the Venezuelan government in attempting to restrict production both in South America and in the Middle East in agreement with the Arab producing countries. But all these restrictive moves ignore the interests of the consuming countries who either lack production of their own or whose production is insufficient for their own needs. They also ignore the fact that few of the producing countries are in the same relative stages of economic and social (as well as political) development, or in their experience in the operations of the oil industry. Therefore it would seem difficult for them to agree upon a broad policy of restricting production. Further, the discovery and development of oil in the Sahara introduces a significant competitive factor to be reckoned with.

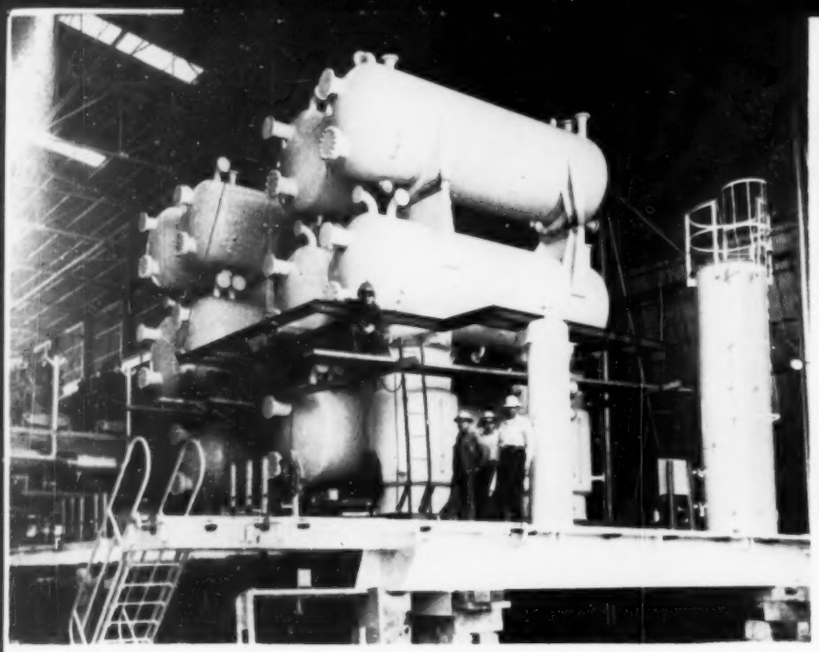
Although the prospects of the Venezuelans and the Arabs, plus any others they may interest, of arriving at generally acceptable conservation laws seem therefor somewhat remote, whatever may be the out-

(Continued on page 124)

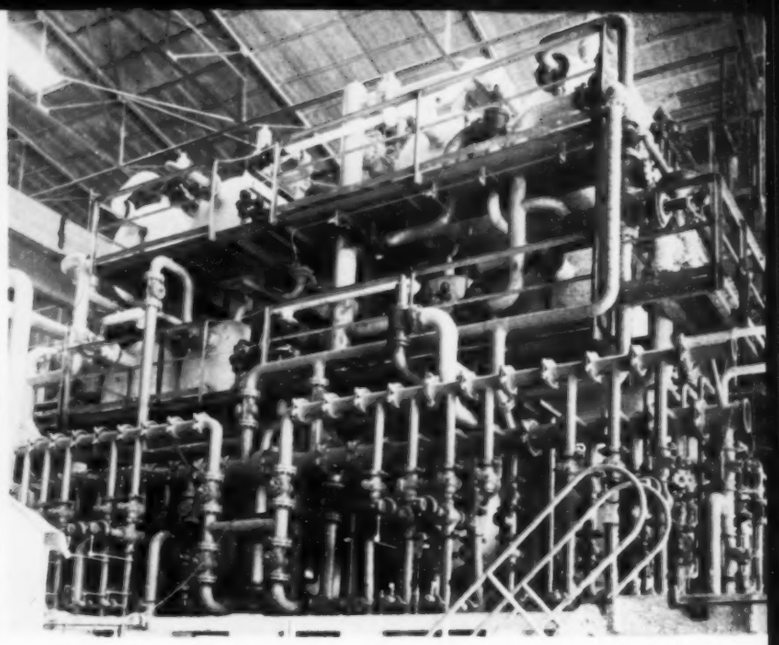
HARLEY C. STEVENS, San Francisco attorney and consultant on Middle Eastern affairs, was manager of the tax department for Standard Oil Co. of California prior to his service in World War II. On return to Socal he was loaned to Caltex and subsequently to Trans Arabian Pipe Line Co. for service in the Middle East.

He resigned in 1947 to become assistant to the president of American Independent Oil Co. and special counsel on concession affairs. Following the Neutral Zone discovery he was made vice president in charge of marketing. He resigned from American Independent last June to become an independent consultant in international oil and other matters in Europe and the Middle East.

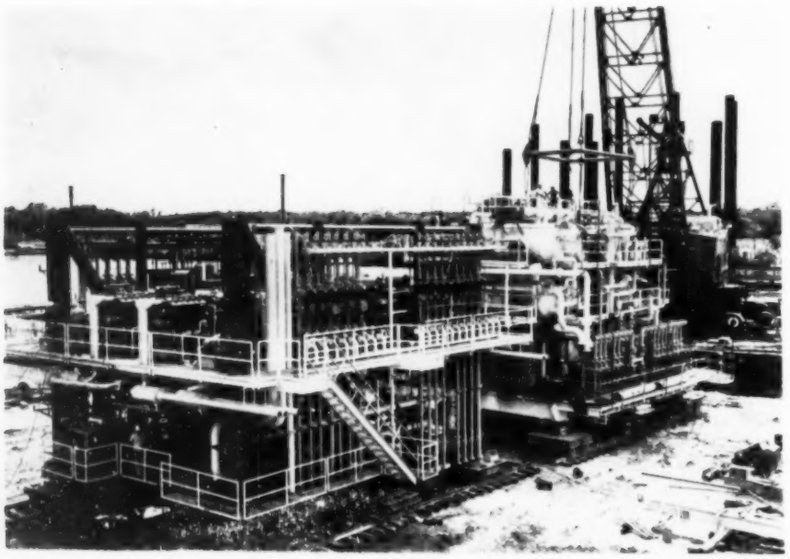
Mr. Stevens is a director of the Middle East Institute and the Near East Foundation. He has lectured on Middle East political and economic affairs and written a number of articles on these subjects.



Separator unit being fabricated for installation on top deck of flow station. High- and low-pressure separators are above and two test tanks below. All photos on this page by Jesse Grice.



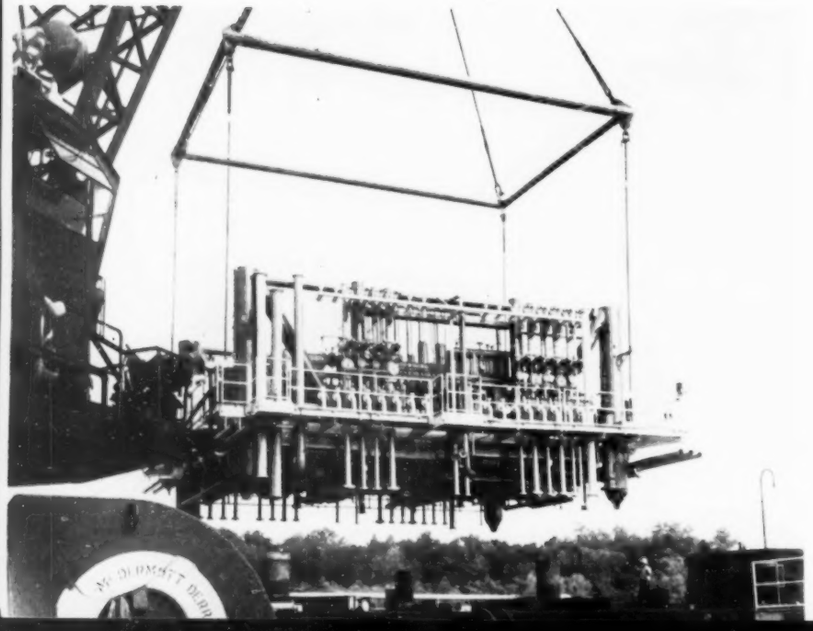
Completed separator bank after installation of piping and valves at McDermott's Bayou Bocat, Louisiana, fabrication plant.

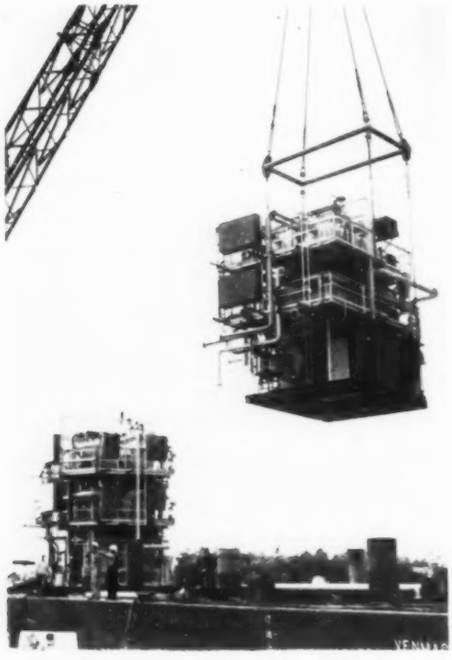


Left: Moving day. Completely assembled decks for flow station are towed to sea-going barge for voyage to Venezuela. Two lower decks—caisson and pump decks—are in the foreground, the separator deck is closest to the barge.

Lower left: Pump deck which carries power plant, generators and pumps being lifted as a unit aboard the Ven-Mac No. 2 barge.

Below: Separator banks were lifted aboard in two sections. Instrument panel is enclosed in the housing at base of unit in the air.





Automated production platform

A single non-attended platform designed to gather and separate 100,000 barrels of oil daily for Venezuelan Sun and associated companies from 46 single and dual completed wells in Lake Maracaibo

By S. S. Roszel, Jr.

VENEZUELAN SUN OIL COMPANY has recently put into operation a gigantic new conception in the handling of offshore oil producing problems. This new approach to an old problem is being accomplished by an electronically automated production flow station capable of handling 100,000 barrels of oil per day without station supervision.

Production of 46 completions, made up of single and dual completed wells and monitored from a control point about a mile away, is automatically fed into this engineering masterpiece through underwater flow lines from each well for processing and pumping to shore 30-odd miles away. This feat of American know-how and ingenuity was made possible through the teamwork of Venezuelan Sun Oil Co. engineers and the technical and manual work forces of J. Ray McDermott & Co. Inc., who designed, fabricated, transported and installed the facility.

Venezuelan Sun Oil Co. is the operating partner and co-owner with Venezuelan Atlantic Refining Co. and Texaco-Seaboard Inc. of this flow station. It was built at McDermott Fabricators' plant on Bayou Boeuf, near Morgan City, Louisiana, transported to the site on an oceangoing barge, and installed on an aluminum template structure in Lake Maracaibo. Texas Instruments Incorporated, subcontractor to McDermott was responsible for designing, building and installing the instrumentation and electronically automated controls, including "brains" in the nature of digital computers and data loggers.

This intricate assembly of separators, piping, engines, pumps and highly complex electronic equipment consists of a three-deck platform, 30 by 40 feet in size and rising 83 feet above the surface of the lake. It is located on an aluminum jacketed substructure especially designed and fabricated for the purpose.

The lower of the three decks is the caisson deck, so named because it is tied in directly to the caisson, a vertical cylindrical vessel, 91 feet 7 inches long with an inside diameter of 96 inches suspended in the water from the center of the structure. The bottom is tapered to form a 60-degree cone with a 14-inch hole open to the sea to relieve the hydrostatic pressure caused by wave action. The purpose of this vessel is to receive the oil and gas from the separators, provide oil surge volume between the separators and booster pumps, and provide disengaging space for the gas released from the oil entering the caisson.

On the second deck, known as the "pump deck," are located eight De Laval "Imo" pumps which drive the oil ashore, and their power supply consisting of eight LeRoi gas engines. Also on the pump deck are two LeRoi driven generators of 150 kw each. One unique feature of the operation is that fuel for these 275-hp engines is supplied by the residue gas which is separated from the oil, thus eliminating the fuel problem which offshore producers have found to be so vexing.

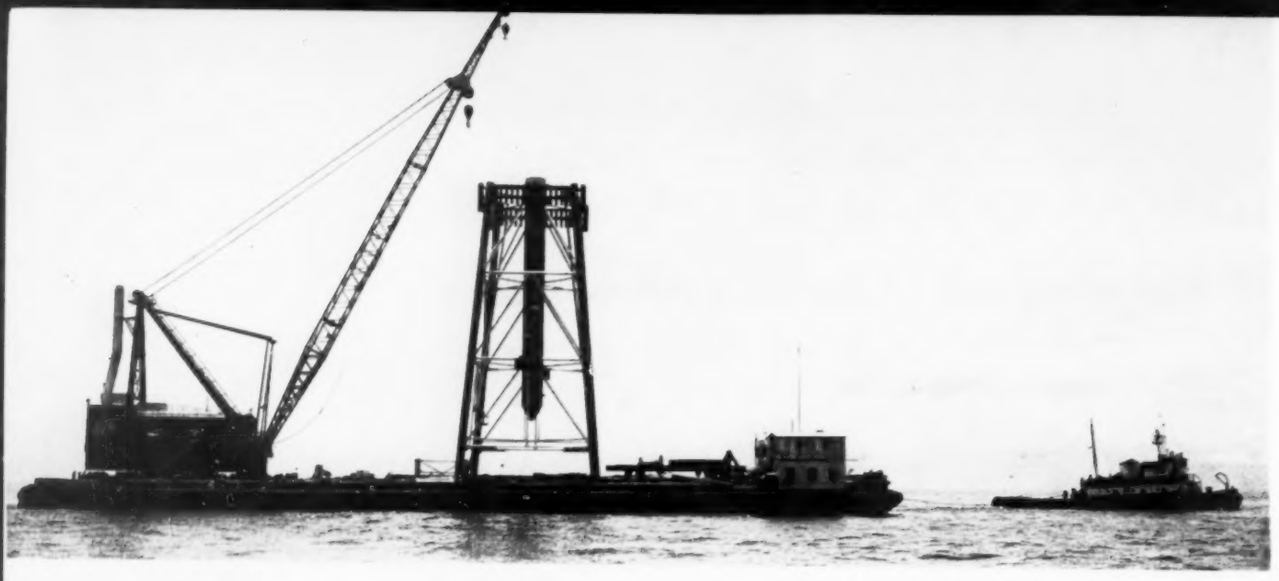
The third and top deck of the installation is known as the "separator deck" and contains two banks of four high pressure and four low pressure production separators and two test separators which may be used as production separators if desired. However, their primary use is in periodically testing each of the well completions to determine the flow rate of gas and oil, specific gravity and the basic sediment and water content of the oil. The room housing the instrument panels on the flow station is built into one of the separator banks which is located on the separator deck.

The "mechanical brain" of this engineering masterpiece is on the junction platform, located about one mile away. This is the pipeline junction for this and other contemplated stations in this Lake Maracaibo field, and is the "take off" point for the 35-mile main transmission line to shore.

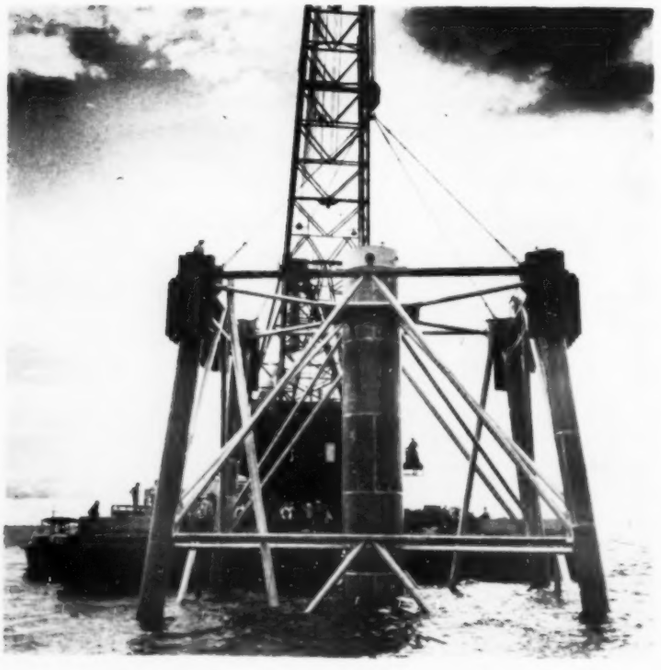
By means of this electronic "brain" the entire operation of the installation is controlled without attendance on the flow station platform. This instrumentation provides full remote control from the central data gathering point on the junction platform. It can monitor pressure and flow of oil from each multiple completion, shutting in the completion and sounding an alarm in the event of some undesirable condition; it monitors and controls the normal platform operation, recording the required information on tape for periods up to 30 days. It can start and stop the pumps, generators and compressors as required; test reservoir pressures and perform all of the tasks necessary for the production of an oil field.

This automatic control can initiate, conduct, record and terminate periodic testing of each well completion flowing to the platform, to determine the gas and oil flow rate, the BS & W content and the oil and gas specific gravity; it monitors the BS & W content from each of the four production separa-

S. S. Roszell, Jr. was an aviator in World War II first with the Royal Air Force and later with the American forces. Following the war his first experience in the petroleum industry was as an aviator in offshore amphibious air transportation in the Gulf of Mexico. After several years in the aviation department of a major oil company he became experienced in drilling, production and land operations. After a two-year period as general sales manager for Eastman Oil Well Survey Co. he joined J. Ray McDermott Co., Inc. in 1959 as director of industrial and public relations.



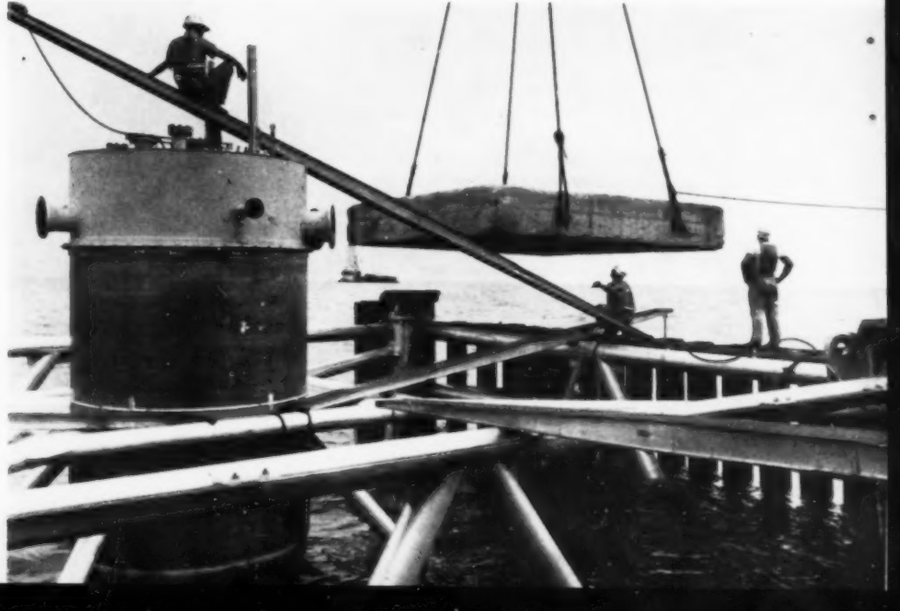
Above: Aluminum substructure en route to Lake Maracaibo location. Aluminum cylinder suspended in foundation structure is designed as a surge tank. Submerged caisson is open at base of bottom cone and oil in it floats on water to minimize surges of weight.

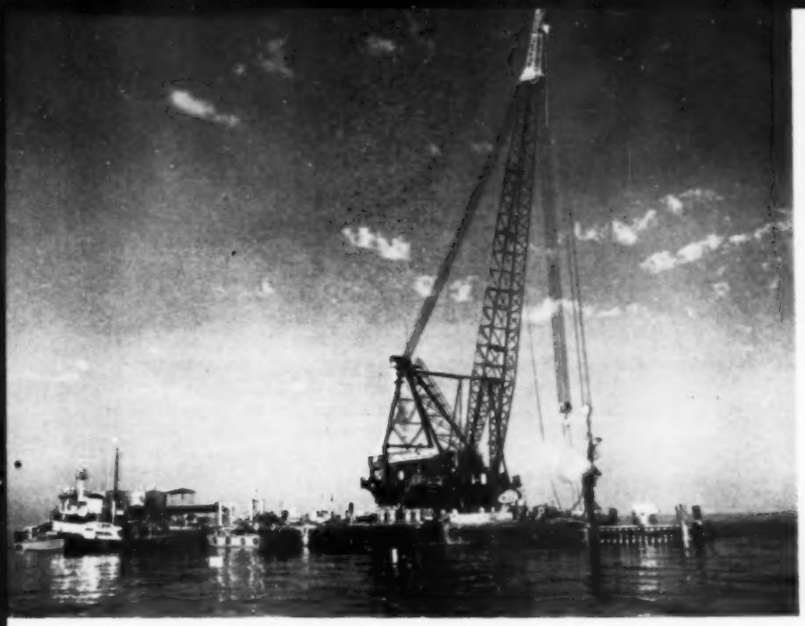


Above: Preparing to lift aluminum substructure for lowering to lake floor. All photos on this page by Robert Yarnall Richie.

Above right: Substructure is being lowered to position by McDermott's derrick barge No. 1 equipped with 200-ton crane.

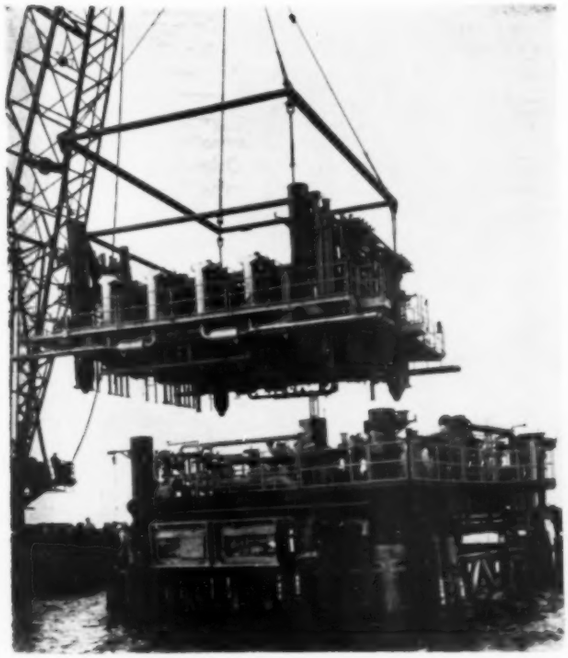
Right: Substructure was pressed to proper depth below floor of lake by 25-ton concrete blocks. Corners were leveled exactly with aid of transit.



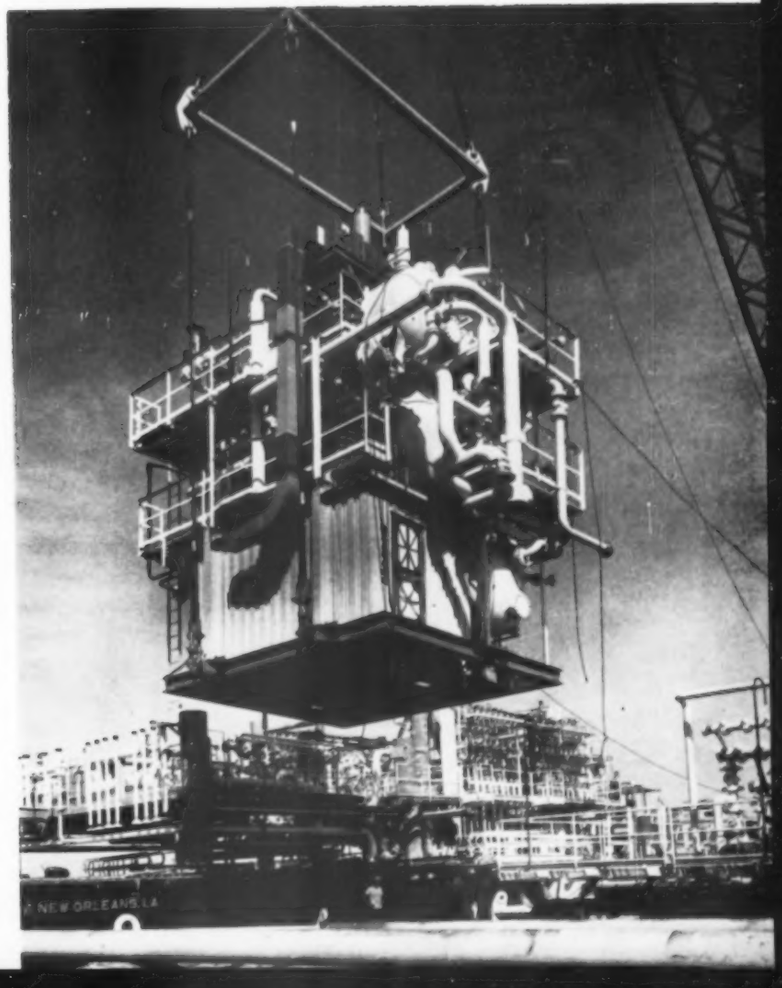


Above: Piles 220 feet long are driven through aluminum legs of the sub-structure penetrating the lake floor 100 to 110 feet. All photos on this page by Robert Yarnall Richie.

Right: Close up of pile-driving operation of large steam hammer at work. Driving has been completed on the pile in the far right jacket leg.



Above: Installation of unitized decks. Lower caisson deck is in place and pump deck is being swung into position. Cone-shaped points at corners are stabbing points which fit into columns of lower deck.



Right: Like the icing on a giant layer cake one section of top separator deck with instrument board housing is lifted.

tor banks and, if an excess BS & W content is detected, it will begin an accelerated test program to search out the offending well. When this well is located it will be automatically shut in while the "brain" resumes its normal sequential testing procedure.

If any trouble develops along the way the "brain" sounds an alarm ashore and also sets off a visual light signal from the platform itself. If a well is shut in, a pump or generator fails to function properly, if there is a well test failure or a fire the automatic control sends out its "SOS," but it doesn't stop there.

The "brain" immediately analyses the trouble and the steps it has taken to correct itself. This information is fed into a teleprinter so that a maintenance engineer can read the report and go to the seat of the trouble without repeating the corrective measures already attempted automatically.

While the exact capacity of the platform depends upon the characteristics of the oil, such as its gravity, viscosity and foaming tendency, as presently designed it is capable of handling 100,000 b/sd of moderately foaming 32.5° API oil, having a viscosity of 13 centiposes at 95° F., with a gas/oil ratio of approximately 800 scf of gas per barrel of flash crude.

Sun engineers estimated that the average oil flow from each completion in this field is 3,000 b/d and the maximum oil flow through any one line from a well platform to the separator is 10,000 b/d. This estimate was the basis for the design.

Both single and dual completion wells are served by the flow station. Only one line carries oil to the separator from each single-completion well platform and this line can be routed either to production or test separators. From platforms having two completions there are two flow lines to the separator, while from well platforms having three or more completions there are two lines to the flow station, one flowing to production and the other to either production or test.

Crude oil and gas from the wells enter the inlet headers and flow to the high pressure separators where the oil and gas is separated at 300 psig. Gas is vented to the atmosphere through a 12-inch line approximately 1,000 feet long, with a certain portion being fed to the pump deck as fuel for the LeRoi motors.

The oil then flows into the low pressure separators which normally operate at 40 psig, and thence to the caisson where the pressure is further reduced to 0.4 psig. A jet injector, using high pressure gas for motive power, raises the caisson gas from 0.4 to about 22 psig to force it into a low pressure vent and thus reach the atmosphere through the common line.

Meanwhile, oil from the caisson is picked up by crude booster pumps and lifted to the suction of the crude transfer pumps which moves the oil through a turbine meter into the main pipeline to shore.

Each of the four pairs of production separators will handle 25,000 b/d of crude oil. The inlet gas oil ratio can range from a minimum of 300 to a maximum of 2,610 scf.

The pump assembly consists of three crude booster pumps, each of which is designed to deliver 1,750 gpm of oil at 17 psig, and the eight crude mainline pumps which can each deliver 12,823 b/sd at 1,000 psig. The total capacity of the eight pumps is 103,000 b/sd. DeLaval "Imo" pumps used are of the rotary screw positive displacement type, having .005" clearance between rotor and stator.

McDermott's process engineering department began planning this project about a year ago and actual construction was begun in February of this year at the company's Bayou Boeuf plant. While fabrication of the structural and process assemblies was taking place in one section of the huge bayou-side yard, the fabrication of the aluminum substructure was taking place in another. Their marine pipeline equipment and work forces were also near completion of the 35-mile long 18-inch main flow line. The flow station was completed by the end of May and by August the plant was on "partial" stream handling 30,000 b/d.

The entire installation in Lake Maracaibo was accomplished with McDermott's Maracaibo-based Derrick Barge No. 4, which measures 300 by 90 feet and has a crane with a lifting capacity of 150 tons. The actual lifting of the flow station to its platform was accomplished in only 12 hours; the final hook-up required about six weeks, the last three weeks being a period of hydrostatic testing and pre-startup activity.

The substructure on which the station is located is in about 90 feet of water and is the type of aluminum construction which has been a feature of McDermott's Lake Maracaibo operations as the world's foremost fabricator of heavy welded aluminum structures.

Because of the highly corrosive water conditions found in this Venezuelan lake, engineers have long since found that marine aluminum alloys provide the greatest resistance to corrosion and have many times the service life of steel. The material employed in the fabrication of these aluminum pipelines, jackets and structures is manufactured by Reynolds Metals Co. and is known commercially as 6061-T6.

The alloy components are composed of Copper (0.25), silicon (0.60), magnesium (1.00), Chromium (0.25) and aluminum (97.90) giving a total of 100 percent by weight. This material is given a solution heat treatment and precipitation heat treatment by the manufacturer before being shipped to the fabricator. The inert gas consumable electrode method of welding is employed, using either Aircomatic, General Electric Filler Arc, or Line Sigma type of equipment.

For those who may be interested in this welding process, degreased 43S welding wire with one-sixteenth diameter level wound on a spool is used. Helium and Argon inert gases are customarily employed in the shielded arc welding, with mixtures set at 70% helium and 30% Argon. However, due to the present scarcity of helium and its employment for defense purposes, Argon is now used almost entirely for commercial welding operations.

The gases create a non-oxidizing envelope around the weld during the period of fusion and penetration of this inert gas envelope must be avoided to prevent contamination. This is achieved by conducting all welding under a canvas shield or other shelter to reduce air currents to a minimum.

The template structure, having four vertical legs laterally braced with the aluminum caisson suspended in the center, was transported to Lake Maracaibo by cargo barge and positioned on the floor of the lake by the derrick barge. It was leveled by means of a 25-ton block of cement alternately placed on each of the four legs to gently drive them into the mud. An engineer sighting through a transit mounted on the derrick barge directed this leveling operation.

Steel piles were then driven through the four specially insulated aluminum legs of the structure and penetrated into the ground approximately 100 to 110 ft. Four neoprene and rubber coated insulating centralizers plus cement grouting pumped into the annulus between the steel piling and the aluminum were used in each leg to prevent electrolysis and galvanic corrosion. A rubber seal at the bottom of each leg keeps the cement in the annulus from flowing out during grouting operations. Tops of the piling were cut off evenly; and the flow station was erected, deck by deck, like the building of a giant layer cake.

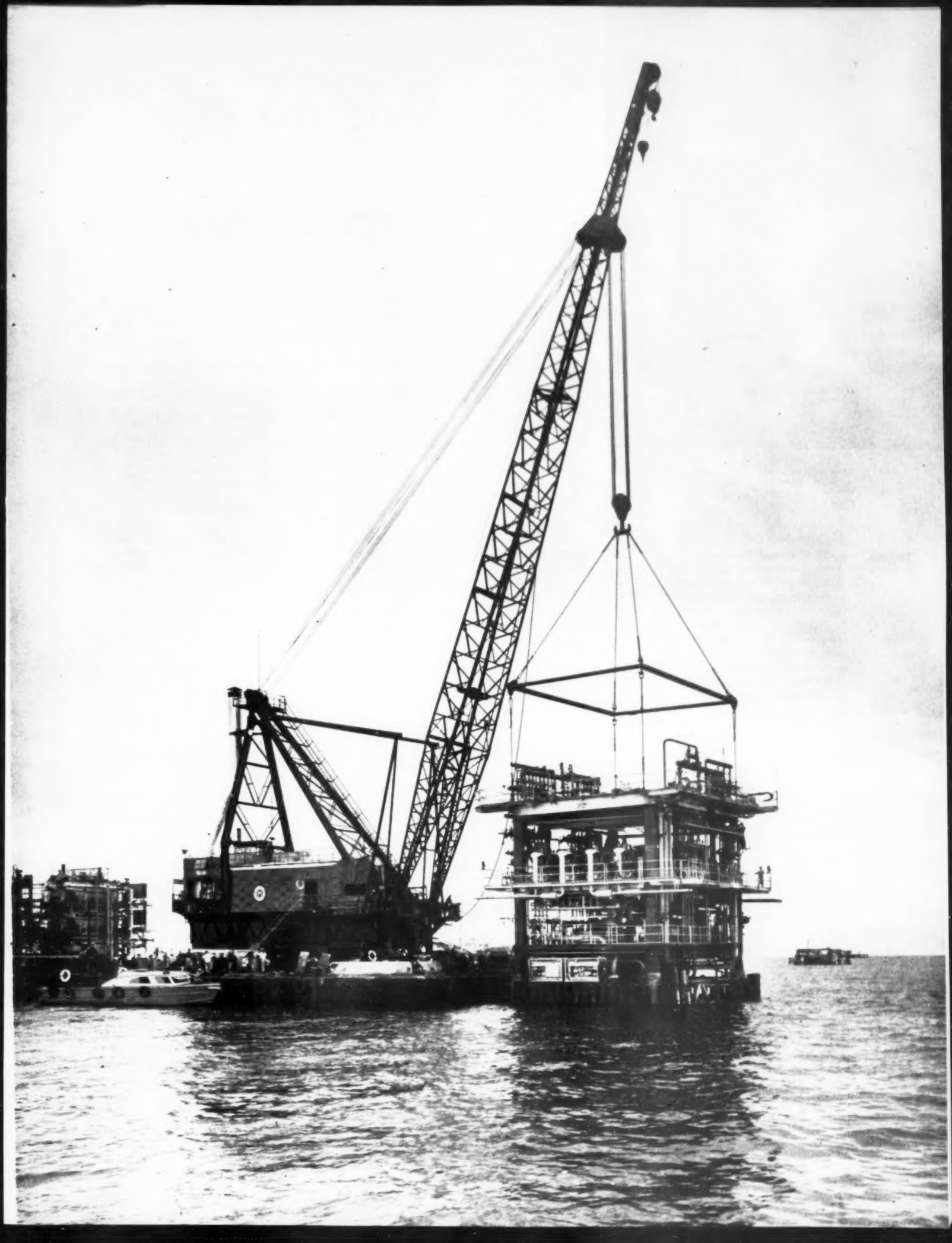
The flow station was moved to Lake Maracaibo aboard the seagoing McDermott barge, VENMAC No. 2. Some 150 McDermott employees were engaged in the over-all designing, construction and installation of the station. Twenty workmen and ten supervisory personnel were sent to Maracaibo from New Orleans to complete the installation, hook-up and service testing of the flow station.

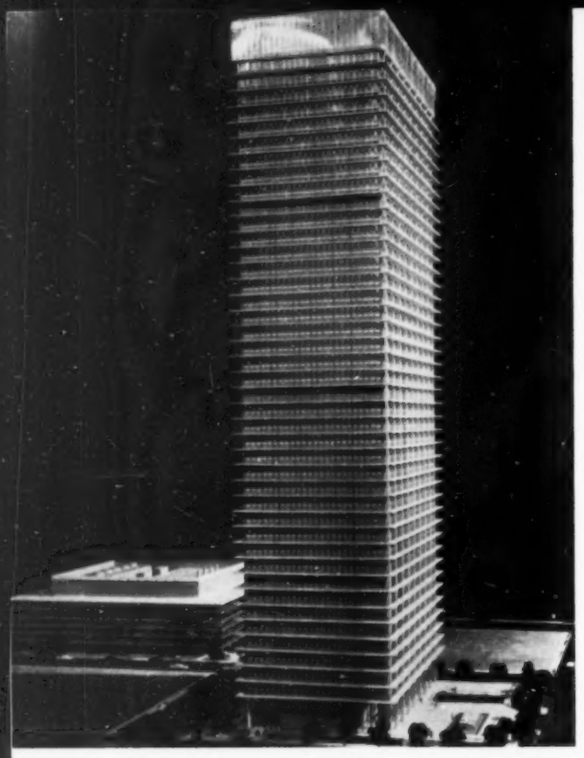
James Cunningham, principal engineer in McDermott's process engineering department in Houston, assisted by John Ruinen and Leon Bates, were in charge of the process engineering-design work; H. W. Bailey, general manager and Jesse Boughton of McDermott Fabricators at Bayou Boeuf, were in charge of the actual construction with Griff C. Lee as the principal structural engineer for the project.

Supervising the work for Venezuelan Sun Oil Co. were J. B. Turner, manager of operations, and his assistants, James Dear, chief civil engineer; and J. M. "Buck" Germany, project engineer, all veterans of the oil industry, while Texas Instruments, subcontractors for the instruments and electronic controls, sent Paul Williams, one of their top engineers, to be project engineer.

J. Ray McDermott & Co., Inc., has more plants of this type in the planning stage and envisions the time when the production of most offshore oil and gas fields will be controlled by man's most modern servant—automation. END.

Third deck fits snugly into place and flow station is ready for installation of two separator units on this deck. Photo by Robert Yarnall Richie.





Jersey Standard's Humble home. It will headquarter Jersey's producing, refining, marketing and marine operations in the United States under the new organization plan.

Shrinking margins spark major reorganizations

Management of international and domestic companies are shaking up established patterns to cut costs, improve efficiency and prepare for competition in tomorrow's markets.

FACED WITH a world surplus of crude oil and an indefinite period of intensified competition the petroleum industry is in the throes of seeking means of halting the slide in profit margins. Mergers and other reorganizations are in progress and management is challenging established operating patterns. Administrative procedures which have been followed for generations are being junked or modified.

Shrinking margins have been general in the oil industry for the past three years or more as a result of higher costs for labor and materials and the recession. Now that business has improved again profits are at a more respectable level but the rise has not been great enough to lull the industry's leaders into a state of complacency.

Annual reports of 14 of the largest integrated companies in the United States showed a profit of 8.2% on $26 billion of net sales in 1958. In the previous year profits had been 9.9% of sales and in 1956 the margin was 10.6%. Earnings compared with net worth fell from 13.3% in 1956 to 9.1% in 1958. In the first six months of the present year the average net profit of a representative group of American companies was 8.5% of net sales compared with 8.2% in the entire year 1958.

Oil is not unique in its financial problems. Productive capacity is ample in most lines of business and prices are not advancing as rapidly as costs. It is easier today to manufacture a piece of machinery or a chemical product than it is to sell it. Most countries are seeking business abroad as, for example, European automobile manufacturers in the United States.

In the USA chemical industry profits slid from 9.7% of net sales in 1956 to 7.9% in 1958. This is a record not unlike that shown by the domestic oil industry. In the steel industry wages have risen 8% per year and productivity 1.5% per year in the past decade.

Although producing capacity of the petroleum industry now is well above consumption, management is confronted with the necessity of making very large capital investments in the next decade or so in order to meet anticipated world energy demands. The Chase Manhattan Bank has estimated that the non-communist world must spend $140 billion for expansion between now and 1967. Much of this, of course, will be spent for refineries, pipelines and marketing facilities although it will be necessary to continue exploration and drilling on an intensive basis if oil demand, as expected, reaches 29,500,000 b/d in the non-communist world in 1967.

The petroleum industry has found it possible in the past to generate about 85% of the capital needed for expansion. The remaining funds have been raised by loans or sale of stock. Management now is concerned about the possibility of continuing to generate capital funds and at the same time to pay reasonable dividends to stockholders. To meet these requirements adequate profit margins must be maintained and, as mentioned before, margins have been shrinking in the face of severe competition of markets.

Referring again to the steel industry the president of one large company recently was asked whether steel prices could be cut if wages are not increased following settlement of the present industry-wide strike. "No," he repaid, "it is essential to retain our present price structure if we are to replace present equipment when it wears out and to expand production facilities to meet the normal growth pattern." He went on to show that depreciation and amortization reserves are never enough to replace steel plants because of spiralling cost.

Income tax regulations in the USA require companies to base depreciation on original cost rather than on replacement costs. This creates real hardship for oil refiners who must constantly be replacing worn out installations with new and more expensive plants. In oil as well as steel it is necessary to maintain healthy profit margins in order to replace as well as expand refineries.

The industry has grown "like Topsy" in the fifteen years since the close of World War II. Oil companies have built magnificent new office buildings only to find that they were too small by the time they were completed and ready to move into. In the view of the top management of some companies, paperwork and the bureaucracy which thrives on reports has proliferated far faster than was needed. Close examination is being given in an effort to reduce head office costs. The goal in some companies is a cut of 10% in technical and intermediate management staff.

The labor content of a gallon of gasoline has never been as great as in a similar weight of most manufactured products offered to the public. Crude is pumped, or may flow, from the ground, then it moves by pipeline and bulk carriers such as the modern supertanker to refineries where manufacturing procedures require no handwork on the product. This is one of the principal reasons why oil prices historically have not risen as rapidly as others. The labor content of the tools with which the oil man

works is high however and this has forced oil costs upward.

Nevertheless the industry is constantly studying methods of increasing production without adding materially to labor costs. An example described elsewhere in this issue is an unattended, automatic flow platform in Lake Maracaibo which now is handling the output of 48 wells—an average production of 100,000 b/d. There are two schools of thought in the industry as to how greater efficiency in company operations can be attained through reorganization. Some companies have for many years conducted continuous studies of organization tables, job analyses, and the men who occupy both intermediate management and higher administrative posts. Standard Oil Co. of California is a notable example.

Particularly within the past two or three years some companies have called in outside consulting firms to audit organization procedures and personnel. It is the contention of the consultants that they can do a better job than can be done by insiders. Executives in the oil companies, they claim, are experts in the techniques of finding, producing or refining but not necessarily of the techniques of administration. They suggest also that outsiders always will be more objective in their studies. They will not be swayed by personal considerations.

Continuous reappraisal of staff and operating functions on a "do it yourself" basis has been done effectively when a special department was set up for the purpose and when top management has adopted the recommendations of men charged with the duty of executive development and appraisal and of the difficult job of saying "No" to requests for more assistants by ambitious men anxious to build their departments.

In the petroleum industry many companies have sought to create a sense of security for employees. It has been said that it is very difficult to be fired by some big companies "if you keep your nose clean and don't shoot your grandmother." This has, of course, had some effect in creating stagnation among naturally timid men. The aims of top management have been to foster both outstanding performance and job security. These two are at least to some extent incompatible. The "fire ball" is willing to risk his job by making decisions which he thinks will promote the interests of his company but which may cost him his job. The security-minded bureaucrat shirks decisions.

The entry of outside consultants into a company tends to impair morale while the reorganization work is in progress. This has been quite apparent recently in the offices of some companies. Consultants think that this type of shaking up and uncertainty is all to the good—that employees will become more alert. Where the reorganization is on a continuous basis and done by a company department this loss of *esprit de corps* is not apparent, or as much in evidence. Proponents of this plan say that continuing alertness is fostered.

In some companies the outside consultants have carried efficiency procedures to great lengths. In one office clerks were instructed to wrap the string only twice around the button on interoffice envelopes. Some clerks had been wrapping it around four times. "Unproductive time" employed in visiting the toilet and for coffee breaks has been checked. Wastes such as these are real and must be eliminated if a company is to be efficient, the consultants argue.

The committee as an apparatus for considering and adopting company and departmental plans has been widely employed in the petroleum industry. In its 75th anniversary history the Standard Oil Co. (N. J.) called attention to the fact that it has long been known as the "Standard Meeting Company." The committee has been employed effectively by many companies while in others it has been looked on as a device for evading responsibility for action. It cannot be denied that committee meetings do use up a great deal of time. Proponents think the time well spent because collective judgment is brought to bear on the problems at hand while critics quote the old definition of a committee as being a group which decides that nothing can be done.

Tendency of management consultants who are brought in is to advise against the committee and to recommend that directors and top management adopt general policies and that department, division, district and plant managers be required to make their own decisions within the general policy framework. They suggest to administrators that they make it a policy to refuse to give advice to managers.

Socony Mobil Oil Co. is one major which has been undergoing a thorough scrutiny and reorganization with the aid of a consulting firm. First job was that of revamping the marketing department and this was followed by recasting the organization table and general corporate structure and a study of job responsibilities. Socony now has embarked on the final step in its reorganization which involves the merger of its principal subsidiaries into one nation-wide domestic organization. Magnolia Petroleum Co. in the southwest and General Petroleum Corp. on the West Coast and Mobil Producing Co. in the Rocky Mountains will disappear.

Standard Oil Co. (N. J.) has adopted a similar policy with respect to its domestic affiliates by announcing that it will merge Esso Standard Oil Co., Pate Oil Co., Oklahoma Oil Co., Carter Oil Co. and Humble Oil and Refining Co. into a single nation-wide operating company.

In the case of the international oil companies it is not possible to create a single world-wide company because of tax and legal regulations imposed by various governments. In some nations foreign interests, for example, must bring in local domestic capital in various percentages. These legal bars to complete integration have not stopped the internationals from making major changes in their organization structures. The Royal Dutch Shell group is an example.

Socony Mobil Oil Co. set up an international division to supervise or coordinate the activities of foreign affiliates. For better operation specialists were placed in general supervisory posts on a regional and functional bases.

Texaco Inc. brought in consultants to study marketing, which is a tender spot in most companies. Reorganization in this case resulted in the elimination of one entire layer in the chain of command in the department. Texaco has traditionally divided its foreign areas by regions and given responsibility over special regions to individual executives in a manner which now has been adopted by Socony Mobil.

To the outside observer it sometimes appears that the companies are adopting the opposite sort of medicine to cure their ills. Some are centralizing and some are decentralizing. In still others it seems to be a mixture of the two.

Gulf Oil Corp. has been a champion of decentralization as a means of improving efficiency and cutting down paper work and lost motion. In Gulf the local organization prepares a budget and plan which is approved and thereafter proceeds on an independent basis, making its own commitments and decisions. Sunray-Mid-Continent is a recent convert to decentralization.

Earlier this year Sinclair Refining Co. decentralized its marketing department. Previously each of Sinclair's eight divisions reported direct to the two marketing vice presidents in New York. Now the divisions are divided into three regions with a vice president in charge of each. The three regional vice presidents report to the New York where a director of marketing and a staff of planners and general supervisors of policy are maintained .

In the case of Socony the corporate setup is to be simplified by the merger of Magnolia and General Petroleum into the parent company. This will eliminate two presidents, two boards of directors and a good many other corporate functions which formerly were in triplicate. Within the organization it is the plan to delegate more authority to intermediate management so that top management at New York can devote more time to overall planning.

Originally the West Coast and Southwestern subsidiaries made sense since California, particularly, was quite isolated from the remainder of the country and had its own special problems of supply and distribution. Since World War II this has become less and less true so in the view of Socony management the autonomous subsidiaries were obsolete.

In the case of the Jersey company, particularly, the parent company has been at great pains to allow its subsidiary and affiliated companies full independence. The parent company maintained coordinators who were available for consultation but each affiliate was autonomous. The reor-

ganization of Jersey which is just beginning and that at Socony which is nearing its conclusion represents perhaps the most fundamental change in management policy since the dissolution of the old Standard Oil Co. in 1911. In the case of Socony individual responsibility is taking the place of group decisions. It is not yet clear whether this will be the policy of Jersey in its new nation-wide operating company.

Perhaps a majority of oil companies have sought to maintain the policy that each department and each division should make a profit on its operations. This is a concept which was fostered by the smaller non-integrated elements in the industry. The independent producer has been voluble in asserting that the producing segment of the industry must be operated at a profit so that control will not pass into the hands of the big integrated company. The independent refiner has had the same attitude but, in this case, the harsh facts of competitive life have been that the refiner has become integrated or has disappeared. The independent jobber has had strong political support for his contention that the jobbing and retail business must make a profit. There is trouble with the politicians if margins are not maintained by the big integrated companies which permit the independent to prosper.

Some of the consultants believe that a profit for each branch of a major company is not necessary. Their view is that the object of the company is to make a profit on its entire operations and that it does not matter too much whether each function is profitable. It remains to be seen how far they will be able to sell this view to big company management.

In addition to the mergers taking place within the major companies there have been two notable projects for merging unaffiliated organizations. Outstanding was the Superior Oil-Texaco, Inc. proposal which now has been abandoned because of government opposition. The government took the position that Superior and Texaco were competitors to some degree and hence the merger should not be permitted.

The Superior-Texaco deal highlights the problem of the non-integrated producing company in today's period of crude surpluses. Superior has very large reserves but no refineries and is hard put to dispose of its crude. Other independents who have gone abroad and developed flush production are in the same difficult situation. Import controls imposed at the instance of the independent producers are now hurting those independents who have gone abroad.

Another proposed merger, between Tidewater Oil Co. and Skelly Oil Co., has been abandoned, but not because of government intervention. In this case it was proposed to create a new nation-wide company with Skelly filling in much of the gap between Tidewater's eastern and western divisions. The merger appears to have failed because Skelly's crude isn't needed as badly as before and relative values of the two stocks have changed.

The entire program of self-examination, reorganization and mergers which have been undertaken by top management in recent months reveal that the industry is alert to changing conditions both in the domestic and international fields. With lines of communication shortened and waste being eliminated the industry should have its house in order and be ready to meet the challenge of oversupply in a world which is hungry for more energy.

Royal Dutch/Shell Reorganization Plan

On APRIL 6, 1959, Royal Dutch Shell was streamlined and four new companies, subsidiaries of The Shell Petroleum Co. Ltd. and Bataafsche Petroleum Maatschappij N. V. (owners of the Royal Dutch/Shell Group), came into operation. They split the oil and chemical business of the Group and took over responsibility for giving advise and services to the many operating companies around the world. Shell Petroleum and BPM now function mainly in a shareholding capacity. The new companies are:

For oil: in London Shell International Petroleum Co. Ltd.; in the Hague-Bataafsche Internationale Petroleum Mij., N. V.

For Chemicals: in London Shell International Chemical Co. Ltd.; in the Hague-Bataafsche Internationale Chemie Mij., N. V.

"Basic differences" were given as the reason for the split of the chemical business from oil. The Group's chemical business, now accounting for 8% of its total sales by value, has grown at the rate of 19% yearly and has multiplied nearly two and one-half times in the last five years.

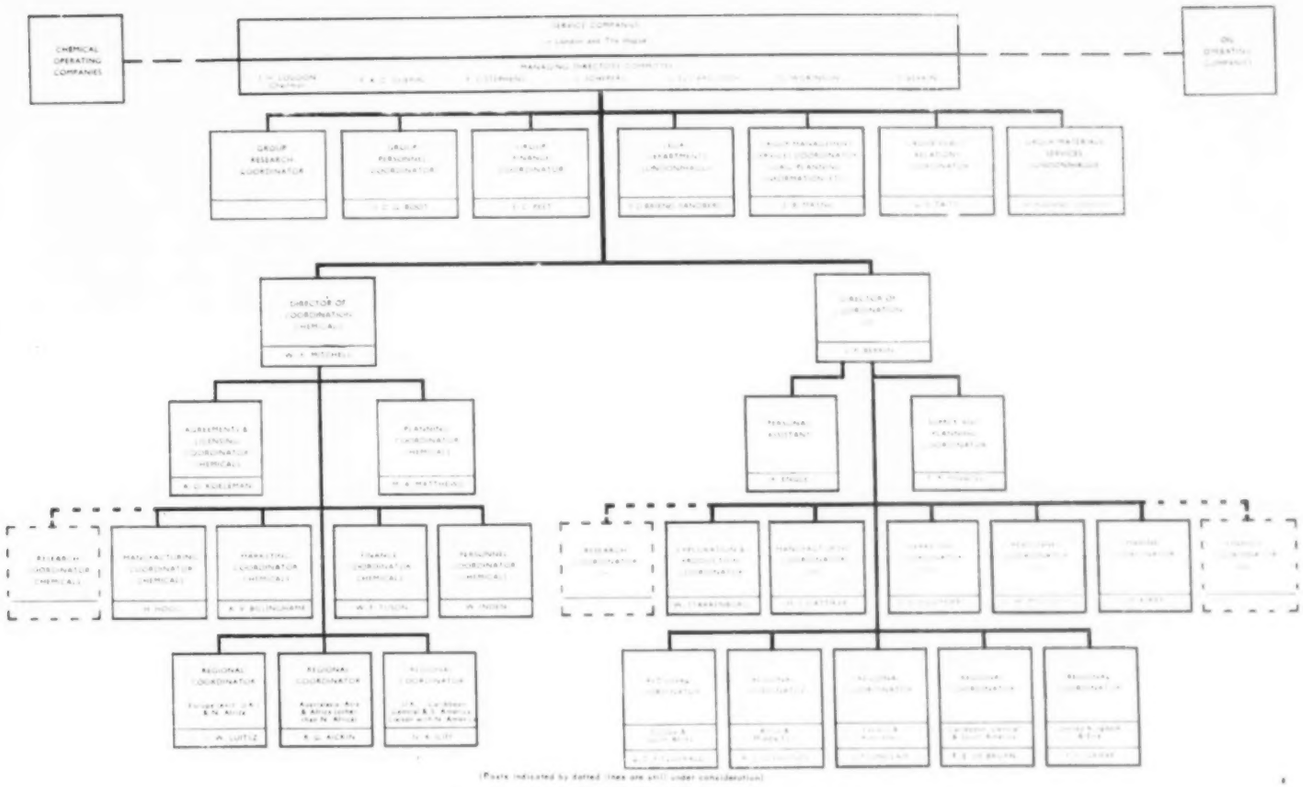
Why Did Shell Reorganize? Competition and expanding markets supply the basic reason, but the best answer comes from the person responsible, John H. Loudon. He now heads the "Committee of Managing Directors" which coordinate all the Group's operations. In Mr. Loudon's words, "At the end of the war, the first task was to get back into normal operation and to re-establish the position of the Royal Dutch Shell Group of companies in the world-wide market. Not unnaturally, this was done within the framework of the existing organization, which in 1945 did not differ greatly from that which existed before the war.

"During the last two years the rate of growth of industry and commerce has slowed down, but trade is still generally expanding and can be expected to do so at substantial rate in the future. This is particularly true of the oil and chemical industries and if general expectations are fulfilled the world will be consuming before 1975 at least twice the present volume of the products in which Group companies deal. With the prospect of expansion on this scale, and also the increase in competition with which we will continue to be faced in the years ahead, it is clearly necessary to make sure that the organization is not only studying today's requirement but is flexible enough to meet the needs of the future."

Utilizing the services of a leading United States firm of management consultants, McKinsey and Co., the coordinating offices of the Group in London and the Hague were reorganized. The reorganization did not extend down into the operating companies themselves. It was aimed at improving communication between Shell Petroleum and BPM. As a result, Shell Petroleum and BPM now function only as stockholders, while the four new companies are "complementary parts of an integrated organization whose job it is to coordinate the activities of Group companies (outside North America) and provide them with advice and services previously rendered by Shell Petroleum and BPM."

Brain of this industrial complex is a nucleus of seven individuals known as the "Managing Directors of the Royal Dutch/Shell Group." They are directors of the new service companies and also constitute a joint committee called the Managing Directors Committee. The members are Messrs. Guepin, Stephens, Schepers, Brouwer, Wilkinson, and Berkin, with J. H. Loudon as chairman. The committee considers, develops and decides on overall objectives, policies and long-term plans to be recommended to the several hundred operating companies comprising the Royal Dutch Shell Group. Responsibility for the day-to-day coordination of the operating companies (outside North America) is in the hands of two executives, a Director of Coordination Oil and a Director of Coordination Chemicals, abbreviated DCO and DCC respectively. Each is a managing director as well. They are in close touch with the Group's affairs but exercise complete executive direction of the operating companies under their jurisdiction.

There remain a number of functions at "Group Level" which report directly to the Managing Directors' Committee through a designated managing director. These functions—research, personnel, finance, legal, management services, public relations, materials—are those which serve both oil and the chemical businesses. Apart from draw-



Royal Dutch Shell Group—the new look.

ing on these common services, both the oil and chemical heads, the DCO and the DCC, have reporting directly to them the staff and functional units which they need for the proper coordination of each business. Their staff includes functional coordinators who are responsible for giving specialist advice world-wide, and regional coordinators who are responsible for giving specialist advice on the whole range of operations of the companies in one geographical region. Each of the regional coordinators will serve all the Group companies operating within the region for which he is responsible.

The personnel function appears at both group level and under the DCO and DCC, since there is a natural split between those personnel responsibilities which directly affect oil and chemical businesses and those which cover both sides of the business and then handled on a Group-wide basis.

Standard Oil Co. (N.J.) Reorganization

H. B. ("Duke") Haight, vice president and director, Humble Oil and Refining Co.

ON SEPTEMBER 2, a plan for reorganization of Standard Oil Co. (New Jersey) affiliates in the United States was announced by M. J. Rathbone, company president. He stated that "this consolidation program, leading as it does to nationwide operation under unified management, will put our domestic business in a much better position to meet the increasing competition that faces us, and to afford employees substantial opportunities through expanding operation."

The original announcement didn't say so, but Jersey plans for reorganization are world-wide. On the domestic scene the company plans ultimate consolidation of the producing, refining, marketing and marine activities of Jersey affiliated companies under unified management.

The principal affiliated companies, presently engaging in producing, refining,

Morgan J. Davis, president and director, Humble Oil and Refining Co.

William Naden, executive vice president & director, Humble Oil and Refining Co.

marketing and marine activities in the United States, are The Carter Oil Co., Esso Standard Oil Co., Humble Oil & Refining Co., Oklahoma Oil Co. and Pate Oil Co. All are 100% owned by Jersey except Humble of which 98.2% is owned by Jersey.

As a preliminary action, Humble (Texas) is to be merged into the Jersey Co. That proposal calls for the following steps:

1. A new Humble Oil & Refining Co. called "Humble (Delaware)" has been organized under the laws of the State of Delaware.

2. Humble (Texas) subject to the necessary approval of its stockholders, would transfer all of its properties and operations to Humble (Delaware) in exchange for 100% of the stock of Humble (Delaware).

3. Humble (Texas) would be merged into the Jersey Co., subject to the necessary approval of the stockholders of each company, and the Jersey Co. would thus acquire direct ownership of all the stock of Humble (Delaware).

Following these steps it is planned to merge The Carter Oil Co. Esso Standard Oil Co., Oklahoma Oil Co. and Pate Oil Co. into Humble (Delaware). The producing, refining, marketing and marine operations of Jersey affiliates in the United States would thus be combined in one corporate entity and under unified management, although it is contemplated that, initially, the units now operating as individual companies will continue to operate, in general, under their present names and managements as divisions of the new company.

In connection with the merger of Humble (Texas) into Jersey, shareholders of Humble (Texas), other than Jersey, receive five shares of Jersey stock for each four shares of Humble (Texas) stock held by them.

The merger arrangement will be complete during late 1960; meanwhile Esso, Carter, Humble, Oklahoma and Pate will continue to do business as at present. After all merger arrangements have been completed they will continue to operate about as they do now, but as divisions of the new company.

Esso Export, Creole's New York City offices, Esso Research and Engineering, Jersey Production Research, Esso Tankers, Butterworth, Gilbert & Barker, and Interstate Pipeline will not be involved in the consolidation. Many trademarks, for example the Esso sign, will continue to be used at least where they are now being used.

In effect, this will transfer all Jersey exploration, producing manufacturing, marketing and marine operations in the United States to Texas, where Humble will preside over them in its new skyscraper home. Officers of the new Humble company have been announced. They are subject to election:

Morgan J. Davis, president and director; John W. Brice, executive vice president and director; William Naden, executive vice president and director; C. E. Reistle, Jr., executive vice president and director; H. W. Ferguson, vice president and director; H. W. Haight, vice president and director; E. D. Reeves, vice president and director.

Naden and Reeves are presently serving as president and executive vice president of Esso Standard Oil Co. Brice and Haight are presently serving as president and chairman of the board of Carter Oil Co. Davis, Reistle and Ferguson are now serving as president, executive vice president and vice president of Humble (Texas).

The board of the new company will be considerably expanded as the needs of the new organization develop. Officers who are not directors have not yet been named and will be announced as they are selected. The headquarters staff of the new company will be built up rather slowly and in the interim period the directors will use the existing staff personnel of the various operating divisions as far as possible.

H. W. Ferguson, vice president and director, Humble Oil and Refining Co.

Like all international companies, Jersey has experienced a rapid growth of its chemical business. Esso Export, world-wide marketing organization for Jersey, recently formed a new chemicals department. It will coordinate supplies of butyl rubber and lubricant additives to Jersey overseas marketing affiliates, and provide them with sales assistance and technical sales service as needed. Staff for the new department is being assembled under the direction of Harold J. Rose, general manager of the new department and a vice president of Esso Export. McVey Graham is manager of the supply division in the new department and P. L. Richards is manager of its sales division.

The domestic consolidation is only part of an effort by Jersey Standard, the company's third step in a world-wide consolidation program. A number of unannounced moves are now underway in various parts of the world. The first was accomplished in Central America and Caribbean, where Essosa (Esso Standard Oil Co. S.A.) expanded to take over Jersey companies (except production operations) in 26 areas and countries throughout Central America and the Caribbean. Esso Mediterranean, in Geneva, Switzerland, took over Jersey littoral affiliates along the shores of the Mediterranean, excluding France, Italy and Greece. Again, exploration and production were omitted. Additional moves will later strengthen Jersey's competitive position by ending up with the smallest possible number of operating companies and a unified control over them. END

E. D. Reeves, vice president and director, Humble Oil and Refining Co.

John W. Brice, executive vice president & director, Humble Oil and Refining Co.

C. E. Reistle, Jr., executive vice president and director, Humble Oil and Refining Co.

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❸ Undisturbed zone (R_t)

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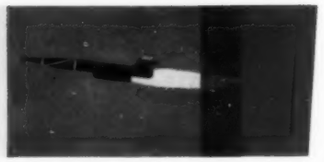

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Can Canada meet Borden's challenge?

Canada's oil industry can increase crude outlets by about 150,000 b/d within the next 18 months, and with a little luck may meet the 200,000 b/d objective set by the Borden Report.

by Leslie Orr Rowland
Editor, *Oil In Canada*

CANADA'S OIL INDUSTRY should show a production increase to about 650,000 b/d by the end of 1960. The increase will come about by normal market growth and intra-industry "swaps," however, not by government intervention. It is probable that even if the industry falls short of the recommended goal of 600,000 b/d production by 1960 that the government of Canada will not intervene to change normal trade channels. It is most unlikely that the Dominion will adopt formally as its own policy the more restrictive recommendations of the report. To do so, as Dr. George E. Britnell, one of the commissioners, pointed out in his partially dissenting supplementary conclusions, would expose it to the risk of being asked to provide market-finding assistance to almost every primary resource industry in the country. Every basic extractive industry has similar problems, but in fact most of the other mineral producers have not had the unrestrained development which has characterized the petroleum industry.

The near-term outlook for greatly increased exports is negligible, even up to the end of 1960, unless there is a phenomenal reversal of the ocean tanker rates. However, within the framework of what is practical in terms of inter-company politics and international commitments, it is easy to visualize some exchange agreements being worked out. They would have to follow the pattern of the current agreement between Imperial Oil Ltd. and Socony Mobil Oil Co., Inc. Imperial takes a proportion of its Montreal East crude supply from Mobil affiliates in South America in return for the acceptance of an equal quantity of Canadian crude in the Ferndale, Wash., refinery of Mobil Oil's subsidiary, General Petroleum Corp.

Shell Oil and Texaco are the most likely companies to be able to enlarge the runs of Canadian crude in their Puget Sound refineries. No company is prepared to make any statements at present about intentions or feasibility. However, it is significant that Shell in the recent past took nearly all its Anacortes crude from Canada, while Texaco's refinery is equipped to run Canadian crude exclusively if it wishes. It appears reasonable to assume that both these companies will be using more Canadian crude by the end of next year.

If the three Puget Sound refineries can be assumed to show a growth at the rate of 10% a year to the end of 1960, or about 12,000 b/d over their 1959 year-end runs, and if Canadian crude could capture two thirds of the total, this would provide Canadian producers with approximately 95,000 b/d in this region. A relatively small amount of additional "swapping" would accomplish this increase of more than 45,000 b/d over recent export volume.

In the northern states there appears to be less prospect for any large bulk increase. Trading of quotas by refiners, plus the pressure of distress crude from North Dakota, makes the region a difficult one except for medium gravity crude at present and for the next year. Exports to these refineries have declined almost steadily since the beginning of 1958 and currently stand at 35% less than they were in the first quarter of 1958.

There is an encouraging projection ahead, however, as last quarter nomination estimates show a rising trend from 45,000 b/d in October to 51,000 b/d in December. The end of the steel strike will contribute to an increase also, as the Minnesota-Wisconsin demand for petroleum products has been cut severely by the closing of the big iron mines and related industries, including a great deal of diesel rail fuel. This has been a special factor tending to depress the acceptances of Canadian crude.

If a similar projection of demand growth is applied, and if it can be assumed that Canadian crude will regain the volume which it had 20 months ago, of around 70,000 b/d plus the growth increment, Canada should be selling nearly 80,000 b/d in this market at the end of 1960. The region is shielded from the direct competition of water-borne crude, and thus the impact of quota trades is diluted by the distance, providing a more stable market for Canadian crude than the west coast where swings have been much more pronounced.

The figure of 80,000 b/d would represent a gain of at least 30,000 b/d over current exports, so the projection indicates an attainable rise of 75,000 b/d in exports, without resort to any compulsive measures, to a total of 175,000 b/d.

The domestic demand growth, which slackened to almost zero in 1958, has been booming at better than 15% a year so far in 1959. This trend can hardly be expected to continue throughout 1960, but if a cautious assumption of 10% increase is applied to the present volume of around 400,000 b/d, the end of 1960 should see a growth of at least 40,000 b/d in present markets which are divided almost equally between Ontario and the western provinces.

The past three years have witnessed a conscious and deliberate policy by the major integrated companies to divert crude runs from Montreal refineries to Toronto or Sarnia, as fast as marketing arrangements could be changed without undue disturbance, in order to attain ultimate self-sufficiency of product supply within Ontario from domestic crude. The range of competibility of Quebec produced products has already been pushed back to the extent that the Trans-Northern pipeline has started to reduce its deliveries in Ontario and at times is carrying products eastward from Toronto. There is approximately 50,000 b/d remaining of products supplied from Quebec. The residual quantity represents a more difficult problem, as two refiners involved (Canadian Petrofina and British Petroleum) have no Ontario refineries and cannot switch runs.

However a clue to the future possibilities on the broad scale may be found in the fact that Ontario demand for domestic crude in the first eight months of 1959 increased by 25% or 37,000 over the same period of 1958. Currently standing at around 210,000 Ontario demand could be expected to be increased by half the remaining self-sufficiency gap during the next year, thereby adding 25,000, plus the growth increment, for a total of almost 30,000.

Now, if all these increments are added together, they amount to 145,000 and boost the total market for Canadian crude to about 650,000 by the end of 1960, compared with its current level of just over 500,000. The domestic share would be 475,000 against 400,000 at present, and the export market 175,000 b/d.

The increase is divided just about equally between the export market and domestic sales, and it would represent substantial compliance with the directive in the Borden Report. It appears to be attainable within the limits of present company policy and moderately extended efforts of the major companies. It would almost certainly be enough to enable the petroleum industry to avoid the risk of being saddled with import controls, quotas or any other government regulatory machinery. It is possible, too, that another 50,000 could be secured with no real disturbance to trade channels.

END

The changing auto pattern — and

THE YEAR 1960 will go down as a significant turning point in U. S. automobile manufacturing trends, brought about primarily by the car driving public's increasing desire for economy as evidenced by its mounting interest in small, compact cars.

Faced with sagging sales of their own models and a rapidly growing market for both European and U. S. small cars, Detroit's Big Three last month introduced their own versions of the compact car among their 1960 models. In addition, all the U. S. builders are holding the line on compression ratios; there will be no change in the average compression ratio of next year's models.

The three newest cars are General Motor's Corvair, Ford's Falcon, and Chrysler's Valiant. All are low horsepower, low gas consumption cars, considerably lighter than conventional models and offered at relatively low selling prices—about $2,000 for six-passenger, two- and four-door sedans. Pertinent engine and body data are shown in Table I, in comparison with current models of two other U. S. built small cars—American Motors' Rambler American and Studebaker Packard's Lark—as well as the Volkswagen and the three currently standard U. S. low-priced cars.

All three of the new compacts are almost as big on the inside as regular models, yet they are almost a foot narrower and close to three feet shorter, with actual wheelbase about a foot shorter. They have considerably lower horsepower and are nearly ¾ ton lighter in weight. They have standard manual transmission with three speeds forward, but automatic transmission is available at extra cost.

In general, they resemble more closely the Rambler American and the Lark than they do the more popular imports such as Volkswagen, Renault, English Ford, Fiat, Hillman, Volvo, and others. However, some oil industry observers believe that by 1962 the major U. S. manufacturers may bring out another group of cars, four-passenger models in a price range to compete directly with the tinier imports.

In addition to the Corvair, Falcon and Valiant; two intermediate compact cars will be coming out in the next few weeks. Chrysler's Dodge Division will introduce the Dart, which will have most of the same specifications as the standard Plymouth but with a slightly bored-out version of the new Valiant Six engine. Ford's Mercury Division will introduce "sometime in the spring of 1960" its new Comet, falling in a price range between the Falcon and the standard Ford. The Comet is expected to use a 6-cylinder, water cooled engine in the 100 hp class to drive a car weighing some 2500 lb. It will have a 113-in. wheelbase, overall length of about 193 in., width of some 73 in., and height about 52 in.

By the fall of 1960, the Edsel will become a compact car only slightly bigger than the Falcon. At the same time, Pontiac, Oldsmobile, Buick, Mercury, De Soto, and Chrysler will introduce compact versions based on their standard-size cars. And a year later, "luxury compacts" are expected from Cadillac, Imperial and Lincoln.

What will these changes mean . . . ?

TABLE 1—HOW THE NEWEST SMALL CARS COMPARE WITH OTHER 1960 MODELS
(Data are for six-passenger sedans except where otherwise noted)

Specifications	Corvair	Falcon	Valiant	Volkswagen(a)	Rambler American	Lark (1959)	Chevrolet(b)	Ford(b)	Plymouth(b)
Engine:									
Location	Rear	Front	Front	Rear	Front	Front	Front	Front	Front
Type	Hor.-opposed	Convent.	Convent.	Hor.-opposed	Convent.	Convent.	Convent.	Convent.	Convent.
Cooling system	Air	Water	Water	Air	Water	Water	Water	Water	Water
Cylinders	6	6	6	4	6	6	6	6	6
Compression Ratio	8.0	8.7	8.5	6.6	8.0	8.3	8.25	8.4	8.5
Displacement, cu. in.	140.0	144.3	170	72.74	195.6	169.6	235.5	223.0	225.0
Horsepower @ rpm	80-4400	90	100	36-3700	90-3800	90-4000	135-4000	145-4000	132-3600
Average mpg, est.	25	25	25	32	—	—	—	—	—
Car:									
Wheelbase, in.	108.0	109.5	106.5	94.5	100.0	108.5	119.0	119.0	118.0
Overall length, in.	180.0	181.1	184.0	160.0	178.3	175.0	210.8	213.7	209.4
Height, in.	51.3	54.5	53.3	59.0	57.3	57.5	56.0	55.0	54.8
Width, in.	66.9	70.0	70.4	60.6	73.0	71.4	80.8	81.3	78.6
Weight, lbs.	2,340	2,366	2,725	1,609	2,475	2,600	3,645	3,791	3,600(c)
Tires	6.50x13.4	6.00x13	6.50x13	5.60x15	5.90x15	5.90x15	7.50x14	7.50x14	7.50x14

(a) Four-passenger sedan
(b) Standard, 6-cylinder, 6-passenger, 2-door sedan
(c) Estimated

The Corvair, General Motors' new 1960 small car, features a radical change in design with its air-cooled, rear engine.

its meaning to U.S. refiners

by William C. Uhl
Processing Editor

WHAT is the significance of today's automobile trends to U. S. refiners? What has been, and what may be, the effects on motor fuel volume and quality? Has the octane race come to the end? Where might processing go during the next few years? What will happen to the multiple grade system of marketing gasoline? Are gasoline taxes a factor? This article will attempt to provide at least some of the answers.

U. S. oil industry authorities with whom we've discussed these and other questions during recent weeks are in fairly close agreement on most of the major trends for tomorrow, though they have varying opinions on specific details, as would be expected.

Seven major points emerge from a composite of these opinions, tempered with observations by WORLD PETROLEUM's editors. In summary, they are:

(1) If current car makers forecasts are correct, just about one out of every four of the 1960 models sold will be a compact car. And if the small cars really do take hold, they could have a noticeable adverse effect on total gasoline demand within the next five years.

(2) On the other hand, the small car trend will have no immediate significant effect on process technology, and it would take a genuine crystal ball expert to predict how the U. S. public will react to the economy cars. Many oil men believe the slow-down in big and powerful car manufacture may be at most a temporary situation.

(3) The octane race is not ended, although it has slowed down.

(4) The motor fuel quality problem continues to grow more complex, with increased concern on the part of refiners with such factors as cleanliness, icing, vapor lock, gasoline mileage, and ignition "noises."

(5) The importance of road octane performance will grow, leading to part-throttle knock problems and greater emphasis on motor method octane ratings, in turn influencing the selection of processes to produce less sensitive fuels.

(6) Although no major new process breakthroughs appear imminent, research efforts continue strong on process work, and the industry continues to search for new and better additives to help provide the desired performance levels. Two new additives are just about ready for full-scale marketing.

(7) There is a continued strong interest in marketing more than two grades of gasoline, although a number of major oil companies intend to stay with a two-grade system. Also, there might be a shift in the relative volume sold to the lower grades.

The fast-growing share of the total new car market being taken by small cars is shown in Table 2, and their percentage of total U. S. registrations is indicated in Table 3. These figures were presented as part of a paper at the National Petroleum Association fall meeting in Atlantic City by Harry L. Moir, vice president and general manager, retail marketing, Pure Oil Co. who also has been serving as chairman of the American Petroleum Institute's Study Group on Stimulating Gasoline Demand.

Although the compact cars represent a relatively small fraction of the total U. S. passenger car population this year, some 3.6%; Mr. Moir sees a rise to 21% by 1964.

The big reason for the small car growth, many industry authorities agree, can be spelled out in one word—economy. And, automobile men point out, this economy means every phase of car ownership: the initial purchase price, gasoline and oil, depreciation, insurance, repairs and maintenance. Most U. S. cars cost their owners an average of about $1,100 per year. In comparison, a Volkswagen's annual cost is around $600. Five years ago, the difference was only $200. This increase has come about primarily from the higher prices for U. S. autos, plus the extra equipment which has been growing in popularity.

Although the new U. S. small cars cannot claim as yet to provide costs in the range of the imports like the Volkswagen, they will certainly bring owners some additional savings. The following table shows what a motorist's annual gasoline expenses would be at selected rates of gasoline consumption from 10 to 30 mpg, based on 10,000 miles/year of driving and a gasoline price of 32¢/gal.:

Fuel Consumption	*Annual Cost*
10 mpg	$320
15 mpg	212
18 mpg	177
20 mpg	160
25 mpg	128
30 mpg	106

(Continued on page 76)

TABLE 2—U. S. PASSENGER CAR SALES, 1954-1964
(Figures in 1,000's)

Year	Total	Large Cars Number	Large Cars %	Compact Cars Number	Compact Cars %
1954	5,535	5,503	99.4	32	0.6
1955	7,170	7,028	98.0	142	2.0
1956	5,955	5,778	97.0	177	3.0
1957	5,982	5,666	94.7	316	5.3
1958	4,651	4,037	87.9	564	12.1
1959*	6,250	5,250	84.0	1,000	16.0
1960	6,500	5,000	76.9	1,500	23.1
1961	6,840	4,640	69.8	2,000	30.2
1962	6,780	4,280	63.1	2,500	36.9
1963	6,920	3,920	56.7	3,000	43.3
1964	7,060	4,060	57.5	3,000	42.5

*Data for 1959-1964 estimated. Sources: Automotive News, 1959 Almanac and Ward's Automotive Report

TABLE 3—U. S. TOTAL PASSENGER REGISTRATIONS, 1954-1964
(Figures in 1,000's)

Year	Total	Large Cars Number	Large Cars %	Compact Cars Number	Compact Cars %
1954	48,324	48,219	—	105	—
1955	51,951	51,718	—	233	—
1956	54,134	53,741	99.3	393	0.7
1957	55,693	55,016	98.8	677	1.2
1958	56,700	55,515	97.9	1,185	2.1
1959*	58,150	56,065	96.4	2,085	3.6
1960	59,840	55,405	92.6	4,435	7.4
1961	61,620	55,385	89.9	6,235	10.1
1962	63,150	54,665	86.6	8,485	13.4
1963	64,810	53,625	83.8	11,185	17.2
1964	66,560	52,675	79.0	13,885	21.0

*Data for 1959 estimated. For 1960 forward, 90% of each years sales from Table 1 accumulated.

The Valiant, Chrysler's new 1960 compact car, uses conventional front engine, but approaches European body design.

ETHYL ANNOUNCES A NEW

"Motor 33 Mix" an important forward step in improving antiknock cost effectiveness

What is it? After years of exhaustive research in the antiknock field, Ethyl introduces to the petroleum industry "Ethyl" Antiknock Compound-TEL-Motor 33 Mix.

This new Motor 33 Mix is an improved and patented formulation incorporating manganese with tetraethyllead, and is the first major advance in antiknock chemistry since Ethyl introduced tetraethyllead.

What does it do? This new development will provide many benefits to both the refiner and the motorist.

1. 33 Mix makes possible a higher antiknock quality than with present antiknock compounds at the same concentrations.

2. 33 Mix improves gasoline's response to TEL making possible octane improvement at lower cost. The charts to the right show this cost effectiveness.

3. 33 Mix provides extra dimension in refining flexibility.

- 33 Mix permits greater use of natural gasoline or virgin light naphtha, economically improving road antiknock performance.
- 33 Mix offers refiners an opportunity to review future plans and delay or eliminate purchase of refining equipment for octane improvement.
- 33 Mix may enable refiners to reduce the amount of aromatics in gasoline through less severe catalytic reforming. This produces better road performance and increases gasoline yield.

How does it work? In Ethyl's new antiknock compound, there is a small quantity of manganese (.05 gram/milliliter of TEL) that has a "promoter" effect on tetraethyllead. This "promoter" effect increases with increasing TEL concentration. It varies with the hydrocarbon composition of the gasoline and, therefore, will vary with the refining situation. This suggests the possibility of selective blending and refining to take advantage of the economics of this new antiknock compound.

The most dramatic demonstration of this "promoter" action can be seen in alkylates and gasolines containing a high percentage of isoparaffins. Note on the charts that fuels showing good response to TEL show excellent response to Motor 33 Mix.

How has it been tested? Before announcing 33 Mix, Ethyl spent several years subjecting this new development to tests in 3 basic areas—in the laboratory, on the road and in trial markets. Here are some of the tests 33 Mix underwent:

1. Laboratory Tested—over 100,000 hours of dynamometer laboratory testing with both single and multicylinder engines, to determine its suitability in engines. In addition, 10,000 road ratings were made to establish its effectiveness in various gasolines.

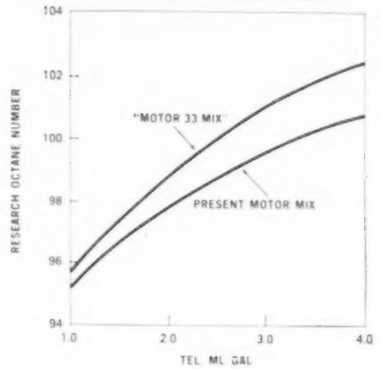
2. Road Tested—more than 7,000,000 vehicle miles in passenger car test fleets. In addition, employee-owned automobiles ran up another 1,500,000 miles of testing. No problems of any magnitude were encountered.

3. Market Tested—thirty-one companies, both large and small, participated in actual trial marketing tests for six months. Over 125,000,000 gallons of treated gasoline were sold to the public across the country with highly satisfactory results.

Further details: For complete details on how 33 Mix can be most advantageously applied to your refining situation, call your Ethyl Representative.

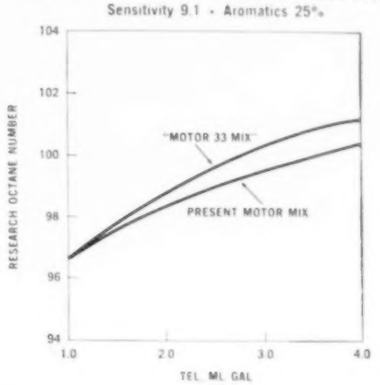
ANTIKNOCK COMPOUND

PREMIUM GASOLINE WITH GOOD ANTIKNOCK RESPONSE
Sensitivity 8.8 • Aromatics 25%



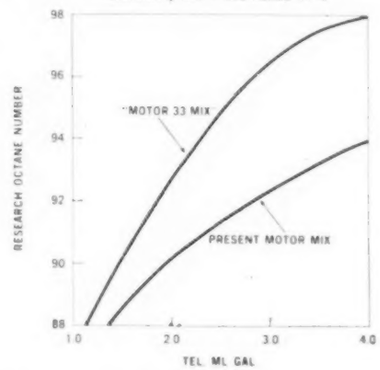
1. The octane improvement costs for the additional octane gained by using Motor 33 Mix are 4.2¢/RONB at the 2 ml TEL level and 4.0¢/RONB at the 3 ml TEL level in the octane range from 98 to 103 RON. Cost figures are very favorable since average processing cost for premium gasoline is about 12¢/RONB.

PREMIUM GASOLINE WITH AVERAGE ANTIKNOCK RESPONSE
Sensitivity 9.1 • Aromatics 25%



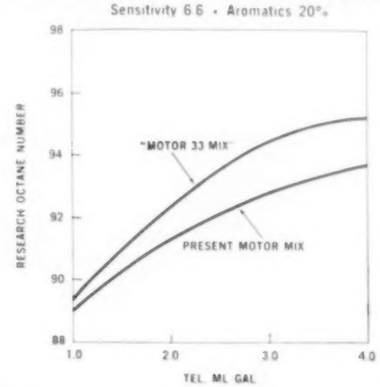
2. Octane improvement costs in this case represent a more typical premium fuel. Antiknock improvement with 33 Mix costs 8.8¢/RONB and 8.7¢/RONB at the 2 and 3 ml/gal TEL levels respectively—and this in the octane range from 98 to 100. Again, very attractive figures when compared to processing improvement costs.

REGULAR GASOLINE WITH GOOD ANTIKNOCK RESPONSE
Sensitivity 2.8 • Aromatics 11%



3. This is a case of regular gasoline with very good antiknock response, typical of premium or regular gasolines with low sensitivity. Antiknock improvement gained by using the new compound is extremely low cost: 2.9¢/RONB at the 1 ml TEL level and only 1.5¢/RONB at the 3 ml TEL level—a favorable comparison with average cost by processing for regular gasoline of 5¢/RONB.

REGULAR GASOLINE WITH AVERAGE ANTIKNOCK RESPONSE
Sensitivity 6.6 • Aromatics 20%



4. This represents a more typical regular gasoline, and here again octane costs suggest the use of the new antiknock. As with most fuels, this is especially true at the 3 ml TEL level where the promoter effect is most prominent. At this point, octane improvement cost with 33 Mix is 3.5¢/RONB—a saving of 1.5¢/RONB for this additional octane improvement when compared with cost by processing.

ETHYL CORPORATION, NEW YORK 17, N.Y. • TULSA • CHICAGO • LOS ANGELES
ETHYL CORPORATION OF CANADA LIMITED, TORONTO • **ETHYL USA (EXPORT)** NEW YORK 17, N.Y.

ETHYL® ANTIKNOCK COMPOUND — ETHYL CORPORATION

The Falcon, Ford Motors' new 1960 small car, represents a change in styling from the company's conventional models.

As indicated in Table 1, the imports claim approximately 30 or more mpg; the new U. S. small models will give an anticipated 25 or more; and the current national average for all cars on the road is about 15 mpg. Furthermore, thanks to heavy increases in taxes—both federal and state governments—the service station price of gasoline has been climbing, and continues to climb. A major portion of the car-buying public is comprised of people who are also employes and/or shareholders of business and industry, and therefore well aware of the virtues of economizing. This is a force on which auto makers are depending.

Average gasoline consumption per car could drop as much as 10.8% during the next five years, assuming the growth in compact cars indicated in Tables 2 and 3, Mr. Moir said. The way this has been calculated is shown in Table 4, using 14.7 mpg as average fuel consumption for large cars and 25 mpg for the small cars.

Several factors can change this trend, according to Mr. Moir and other industry leaders:

(1) A concerted selling effort by the U. S. oil industry; for example, going after a larger share of the public's leisure time dollars. Mr. Russell Weston of the Ethyl Corp. said earlier this year:

"If we could encourage every American motorist to drive *two* additional miles per day, we would sell three billion additional gallons of gasoline, representing an increase of 8% in today's market.

"If we could encourage each American motorist to buy *one* additional tankful of gasoline per *year*, it would amount to an increase of 20 million barrels of gasoline per year, or a reduction of the present gasoline stocks of 11%."

(2) The question is just how accurately the future can be predicted. The public can be influenced markedly by many factors which today are unknown or unanticipated, as many market research scientists have learned from bitter experience. Total car sales may conceivably exceed all expectations, or the public may drive more miles per year, bringing total gasoline demand up instead of down.

Some refining economists see small cars rising to no more than 10% of total car population in the next five years. Others have stated that the demand for "economy cars" will probably level out and become stable within two or three years.

(3) The small cars may catch up with the public, but their present mileage and octane requirements may not continue the same. One oil company vice president told WORLD PETROLEUM:

"I have a hunch that if and when the small car fad catches on, we will find ourselves in a race as to who can build and drive the 'biggest, fanciest, highest performance' little car. I think the fact that there is an octane race in Europe just as surely as there is in this country tends to support the validity of that hunch. If this happens the effect will, therefore, be one of a temporary flattening of both the octane requirement and gasoline consumption curves rather than a change in their direction."

(4) Relatively unnoticed has been a steady increase in sales of station wagons—notoriously high on fuel consumption—from 2.8% of total U. S. sales in 1951 to 15.8% in 1958.

Small cars or not, the octane race will continue, although at a slower pace, most oil men agree. Two companies pointed out that in Europe—where the small car dominates the field—the octane race is just as active as in the U. S.

Beyond 1960, when average compression ratios of new cars will reach a standstill, it is believed they will again rise. One estimate given WORLD PETROLEUM pegs the rate of rise of about 0.25 per year, so that by 1966, the average for all cars will be about 10.4; with some high requirement cars reaching 11.4.

Just how much the octane slow-down will be varies as a matter of studied opinions. Most authorities see premium grade research octane going up at about 0.5 per year and motor method octane at a full point per year over the next five years or so.

Those who argue that the octane race is by no means finished base their conviction on two factors: (1) automotive engine efficiency can be boosted still further by increases in compression ratio, which requires higher octane number fuel, and (2) octane numbers of present gasolines are not the limit that refiners can manufacture by making full use of available octane improvement methods—processes or additives. As one scientifically trained manufacturing vice president put it "not only is there considerable room for further increases in octane levels by present methods, but also the future can bring still more useful developments."

The influence of marketing was cited as a significant force in keeping the octane race going by Union Oil's senior vice president K. E. Kingman, who told WORLD PETROLEUM, "Octanes may have largely lost their glamor from the refiner's point of view, but they have been so thoroughly accepted by the marketer and motorist that they remain an important measure of gasoline quality. I

TABLE 4—ESTIMATED EFFECT OF ECONOMY CARS ON GASOLINE CONSUMPTION IN 1964

Estimated Average Miles Per Gallon:

	1959		1964	
	% Total Cars	mpg	% Total Cars	mpg
Large Cars	96.4	14.7	79.0	14.7
Small Cars	3.6	25.0[a]	21.0[c]	25.0
	100.0	15.0[b]	100.0	16.8

Estimated Gasoline Consumption in 1964:

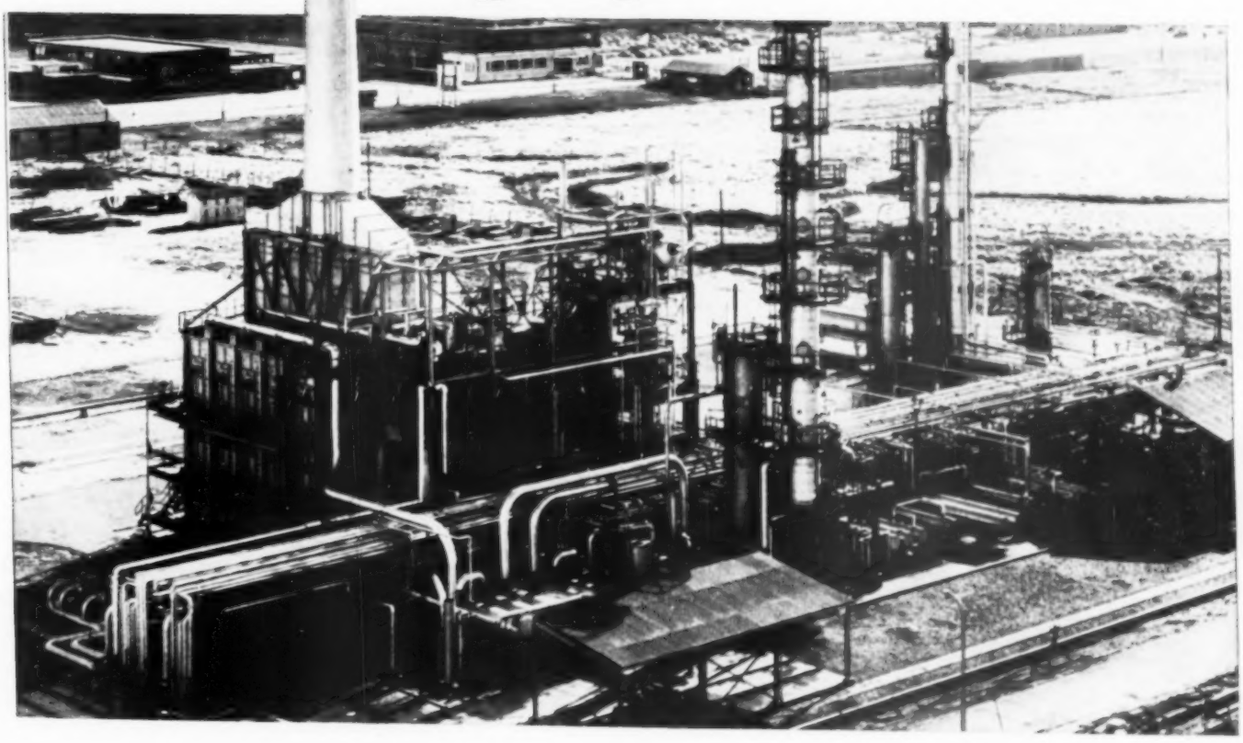
	Total Cars (millions)	Average Miles/Car	Average mpg	Gals per car	Total Gals (millions)
Current Estimate[b]	66.6	9,500	15.0	633	42,135
Revised—assumes small car facts as shown above	66.6	9,500	16.8	565	37,570
					4,565
Potential cuts in sales due to economy cars					—10.8%

(a) Estimated.
(b) From NPN Fact Book, 1959.
(c) From Table 3.

catalysts in action

SPENCE

Spence COMOX catalyst is used for desulphurisation in oil refineries throughout the world. COMOX is noted for its long life, high activity, selectivity and robustness under the most severe operating conditions. Spence Product Development Department will gladly provide further information on COMOX and other catalysts which are available in commercial and development quantities.



Mobil Refinery, Coryton. Photograph by courtesy of Mobil Oil Co. Ltd.

PETER SPENCE & SONS LIMITED, WIDNES, LANCS
Also at London, Bristol and Glasgow

believe 'octane' will be with us for some time to come, but that there will be a shift away from the race for higher octanes in premium gasoline to competition in offering the greatest octane value to the motorist.

"The octane race has been an expression of willingness on the part of refiners to compete for the motorist's trade by recognizing his desire for high performance of his automobile. High octane gasolines have made the development of high horsepower automobiles practical. We have sold octanes in much the same way as the automobile manufacturer has sold horsepower—because the customer wanted it. Now, however, there is strong evidence of a growing desire by the motorist to reduce cost of automobile transportation. This is expressed in the increasing demand for economy automobiles that can use regular gasoline and obtain better mileage per gallon.

"The relative demand for regular gasoline can be expected to increase markedly compared to premium grades. Along with this volume increase for regular grade will come strong pressure for increasing its octane value so that regular gasolines can be used in as many automobiles as possible and the subsequent savings potential will be as widespread as possible."

On the other hand, several arguments were also given that the current octane quality is near its optimum level. The major point advanced was that the incremental cost to the refiner of the additional octanes is still a cogent economic limit. An additional point was made by Jesse C. Ducommun, general manager of manufacturing for Indiana Standard, who said: "The most important automotive design feature affecting octane demand is compression ratio. It is my understanding that 10 or 10.5 compression ratio is a practical upper limit because of uncontrolled combustion of compression ratios above these levels."

One shift in the octane problem pattern on which many refiners agree generally is in the direction of reducing sensitivity (spread between research and motor numbers). With attention currently being directed to better gasoline economy—particularly in the driving, or part-throttle, range—there has been greater emphasis on motor octane number, which measures road antiknock performance under the part-throttle operations, according to Mr. Ducommun and several others.

The trend toward lower sensitivity fuels will continue to have an important effect on processes, pushing the refiner toward more alkylation and isomerization in preference to polymerization.

More catalytic cracking is not seen as the solution to octane and fuel quality problems; however, there is little likelihood that this process will be de-emphasized. It is an important method for upgrading heavier stocks into lighter, more valuable materials.

An interesting possibility is that a refiner might find the economics favorable for putting two catalytic cracking units into his plant: one to process the original crude, and then to separate the various cat cracked naphthas for treating and/or recracking. By removing the basic heartcut from the original cracked stock and reprocessing the other streams by hydrogenation, isomerization or alkylation, the refiner can build more octane qualities into his original charge. This may require subsequent recracking, either with today's catalyst or some of those presently under development.

As long as there is a need for more basic refining capacity and properly balanced operations, this process will retain its top position in popularity. In fact, one refiner anticipates an expansion in catalytic cracking because it does provide the needed tool for balancing between markets for gasoline and those for heavier fuels.

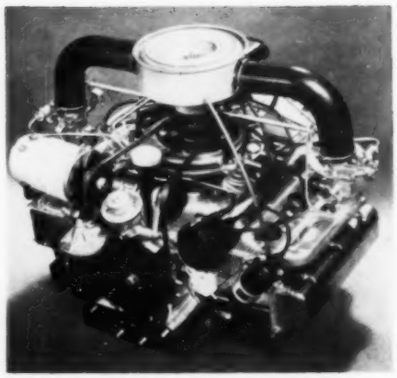
Assuming the continued dominant role of octanes, it is probable that a good part of future motor gasoline will also be obtained by improvements in catalytic reforming, such as recovery of the higher purity aromatics using solvent extraction for the reformates, and improvements in alkylation such as better selection of feed stocks and improved fractionation of the product. Superfractionation and the molecular sieve processes appear to have high promise for the relatively near future.

One regional refining industry problem which at times has been threatening other areas of the U. S. is the smog situation in the Los Angeles basin. A limitation on the olefin content of motor fuels goes into effect there in February, 1960. Set for 12%, this means West Coast processors will undoubtedly boost the aromatics content of their product to around 40-45%, which would require greater emphasis on processes like catalytic reforming.

As for gasoline quality problems other than octane, one Gulf Coast refiner-marketer believes that future motor gasolines will contain an all-purpose additive or combination of additives which will serve as an antirust and anti-icing agent, will be an inhibitor against induction system deposits and deposits in other areas, will prevent spark plug fouling, will supplement tetraethyl lead as an antiknock agent, and will prevent unusual combustion reactions such as "rumble" and "thud." These problems can also be handled to a certain extent by use of such processes as isomerization and alklyation which provide cleaner burning and antirumble properties.

The three-grade-versus-two-grade marketing controversy remains a stand-off, with adherents on each side continuing to offer equally sound reasoning for their policies.

One three-grade proponent believes, however, that there will be a swing to three-grade or multiple grade systems. He bases his thinking on a prediction that octane numbers must continue to rise as a solution to the various combustion problems in the engine and that an equilibrium point will soon be reached in the demand for economy cars. He points to the inherent advantage of three-grade marketing in that it allows the refiner to conserve capital by making it necessary to provide only enough of a very high quality fuel to satisfy those cars which need it. The system also allows the refiner a more fair distribution to the public of the cost of providing octane improvements.



Close-up shows how the new rear-mounted, air-cooled Corvair engine fits neatly into the car.

A Mid-Continent refiner on the other hand states flatly that "a small refinery cannot even look economically at a three-grade system." He feels two grades should adequately serve both the large and the small cars. Still another, medium sized Mid-Continent refiner says not so at all. You pay your money and you take your choice.

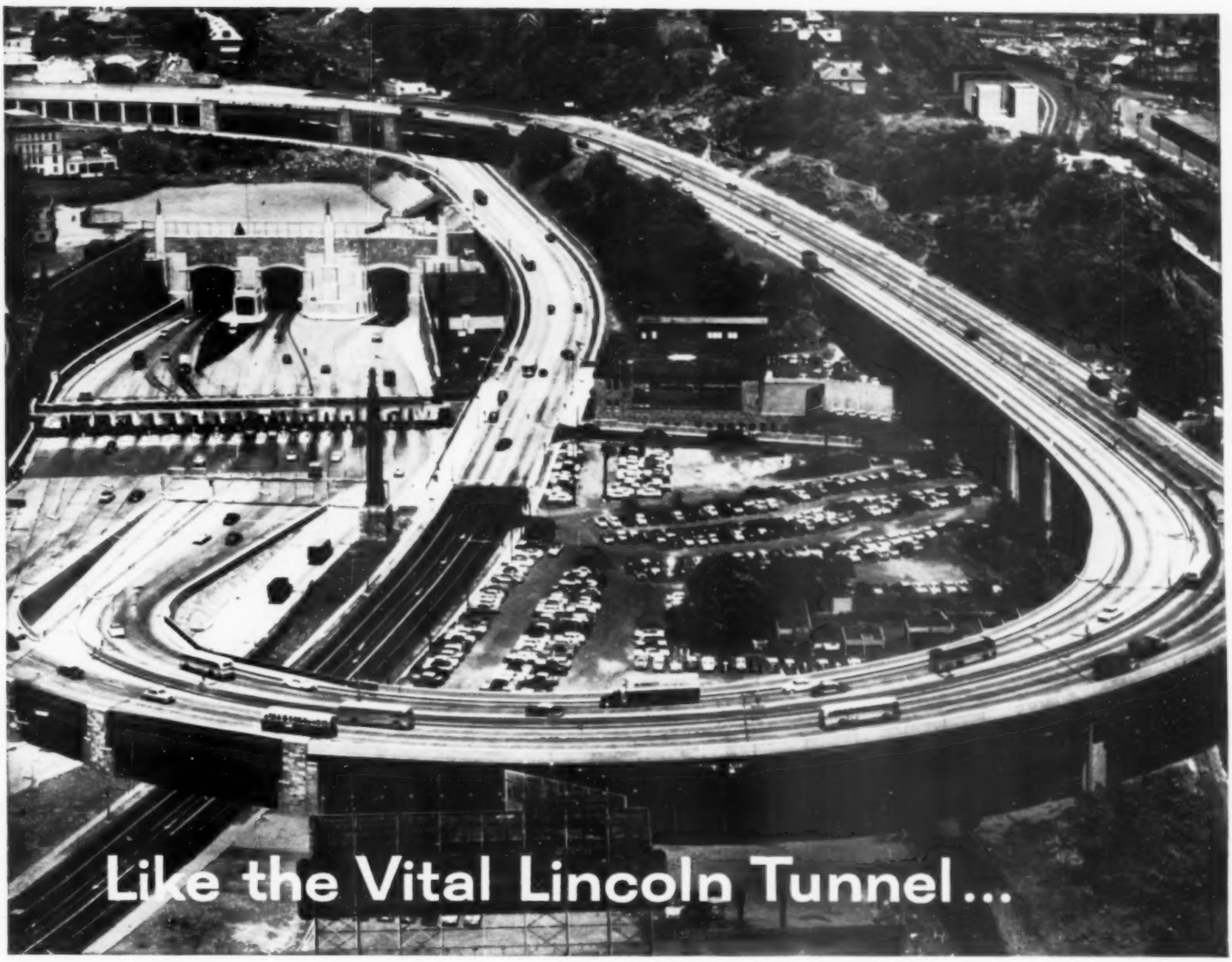
The recent lifting of the permissible tetraethyl lead content in gasoline from 3 cc to 4 cc/gal—the first change in 33 years—will have no immediate significant effect on refining trends, most industry observers believe.

In general most refiners had not yet been using up to the existing limit. In August, rational average TEL concentrations were 2.52 cc/gal for premium fuel and 1.88 cc/gal for regular grades. However, raising the limitation can be expected to give an assist to small and medium size refiners in meeting octane market problems.

As an example: moving from 3 to 4 cc on premium grade would raise its research octane from 99.7 to 100.5, and its motor octane from 90.2 to 91.1. In the case of the super premiums, research octane would go from 102.7 up to 103.5, and motor octane from 93.1 to 94.4.

Two new additives are also expected to have an effect on the future of TEL in motor fuels. Ethyl Corp.'s new Motor 33 Mix is a mixture of TEL and methylcyclopentadienyl manganese tricarbonyl. Texaco's tertiary butyl acetate additive is near full-scale marketing stage. Both are designed for use with lead and to boost octanes as well as provide refiners wider processing flexibility.

In summary, the years immediately ahead are full of a number of interesting developments which might have considerable effect on the U. S. refiner. The potential problems, however, seem no more difficult than those he has met and solved in the past. END



there's more to Cities Service than meets the eye!

Lincoln Tunnel now serves nearly 25 million vehicles annually, with the $100-million third tube greatly easing the flow. Inside, 80 fans provide a complete change of air every $1\frac{1}{2}$ minutes, while a master control board monitors exhaust gases and operates traffic signals.

Millions of motorists enjoy the convenience of the Lincoln Tunnel each year—but few realize the planning, the investment, the mammoth human achievement it represents.

Likewise, the motorist at a service station is seldom aware of what's behind the tankful of gasolene he orders with the simple words "fill 'er up."

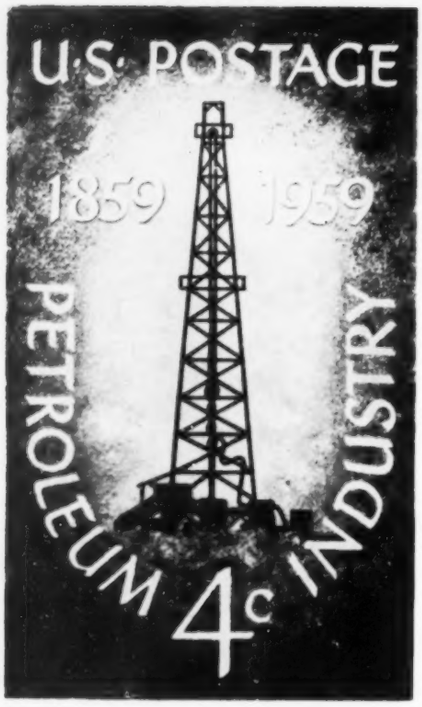
Cities Service, for example, searches four continents to find the oil with which to meet his request. It has its own "navy" of ocean going tankers. It uses a pipeline network that could girdle the globe. Its investment in modern facilities exceeds a billion dollars and its employees and stockholders number nearly a quarter of a million.

Moreover, big as the job of finding oil is today, the petroleum needs of America will continue to grow. Thus, in preparation for the future, Cities Service has invested $350-million just in the last two years.

Only in this way can America be given what she needs for progress—more jobs, more and better petroleum products.

OIL'S FIRST CENTURY
BORN IN FREEDOM
WORKING FOR PROGRESS

CITIES SERVICE



The world of petroleum in stamps

by Luther Williams*

"The rock poured me out rivers of oil." This phrase from the fifth verse, 29th chapter, of Job, in the Old Testament challenges the imagination of every oil man.

The rock oil of the Biblical period was in those days found abundantly in Persia (Iran). Heroditus, some 2,400 years ago, visited the oil springs near Zante, east of the Tigris. The Dead Sea in Palestine is locally called the "Asphalt Lake," from the asphalt abounding on its shores.

Bitumen formed the ancient cement used on the walls of Babylon and the Temple of Solomon. With it the Egyptians embalmed, under the name of "mumia."

Asphalt and its more volatile naphthenic liquids were the old world's "rock oil", from the Greek, Petros Olaion; or the Latin, Petra Oleum.

So it was the "rock oil" combination of naphtha and asphaltum which Col. Edwin L. Drake brought up with his drill at Titusville, Pa., 100 years ago; and as petroleum it has changed the social and economic destiny of the whole human race during the century of progress since.

Today, some 50 countries of the world produce crude oil. For a quick, romantic trip to these places far and near in the oil man's world, there is nothing that will show the international aspects of petroleum quite as effectively as those little bits of paper called postage stamps.

Thirty-six nations have issued 423 stamps whose designs pertain in some way to the oil industry. For a visit to some of these oil-producing countries and a look at their stamps it might be well just to go to that part of the world where, as long ago as 4,000 B.C., men were producing oil, transporting it, and using it.

ASIA

Iran (Persia) issued two sets of colorful oil stamps in February, 1953, to commemorate the discovery of oil at Qum. One design shows an oil well with mosques in the background. The other design, of horizontal format, shows an oil well, mosques, and a monument. A second set consists of four beautiful air mail stamps, each showing a well, mosques, and an airplane.

Iran in 1953 also issued a set of five designs and denominations to commemorate the nationalization of the Iranian industry. One shows oil storage tanks, another pipelines, and three show different views of the Abadan refinery.

In 1958, Iran issued a set of two to commemorate the 50th anniversary of the drilling of the first oil well in Persia. The design shows a hand holding a dish of flaming oil.

Iraq, formerly called Mesopotamia, became a republic under the rule of Kemal Ataturk and in 1923, Iraq issued a stamp showing the guffas, or round boats, on the Tigris River. These guffas are made by stretching skins over palmwood frames and then coating these skins with pitch or asphalt. It may well be that the guffas were the earliest "tankers" of the oil industry.

Iraq later issued two attractive stamps showing three oil wells; and to commemorate the Sixth Arab Engineers' Conference in Bagdad in 1955, one picturing King Faisal II and with two wells. The country has also issued a set of three stamps showing a large pipeline and compressor station.

Pakistan in 1955 issued a stamp showing a scene in the Sui gas field. Its natural gas industry is represented by the Sui well on another set issued in 1957.

Turkey issued a set of two stamps in 1957 to commemorate the 10th anniversary of Turkish-American collaboration. The design, titled "Symbols of Industry and Flags," shows an oil derrick.

Kuwait: This oil-rich land on the Persian

* Sunray Mid Continent Oil Co., Tulsa

Gulf issued ten new stamps in June, 1959, with oil scenes showing new developments and portraits of the Sheik.

China: Communist China has issued two striking oil stamps; one showing an oil field and a refinery, and the other oil wells and tank cars.

Straits Settlements—Singapore: A stamp issued in 1955 includes a beautiful purple and plum colored stamp showing a large oil tanker.

EASTERN EUROPE

Azerbaijan: At the eastern end of the Caucasus Mountains on the Caspian Sea in Azerbaijan, one of the USSR republics, is the city of Baku. On the peninsula and on nearby islands in the Caspian are large oil springs and asphalt deposits which have been known and utilized from time immemorial, and numerous gas seeps that played a major part in one of the greatest religions of the ancient world as practiced by the "Fire Worshipers." This religion's elaborate ritual centered about the "eternal fire" that burned perpetually in or adjacent to the temple. The principal temple was near Baku.

Azerbaijan has issued 30 oil stamps of four different designs; one showing the Temple of Eternal Fire, one a flowing oil well, the third a view in the Bibi-Eibatt oil fields, and the fourth two oil tanks.

Transcaucasian Federated Republics, formed in 1922 by the independent republics, Azerbaijan, Armenia, and Georgia, has issued 17 oil stamps. There are only two complicated designs.

Russia issued in 1933 a set of five large, air mail stamps to commemorate the 10th anniversary of the establishment of civil aviation in the Soviet Union. One of this set is an oil stamp. Light green in color, it has a circle in the center of its square shape showing a large airplane flying over a densely drilled oil field.

The highest value stamp to publicize Soviet industries is a dark blue-green 1-ruble stamp, showing modern steel oil derricks, a refinery, steel storage tanks, and a train of tank cars. Another stamp similar in design and appearance to this one was issued in 1941.

A set of six large stamps, issued in 1947, show a number of oil wells.

In 1948, Russia issued two striking oil stamps, one a 60 kopec red-brown and the other a 1-ruble blue-green, both of the same design: showing an oil field, a well, tank cars, and a refinery. The design of a 1957 issue shows several oil wells under a flag.

Romania holds the oil stamp issuing record at 88. In 1945, this country issued a set of five semi-postal stamps to commemorate the 16th Congress of the General Association of Romanian Engineers. One of these shows an oil field. And in 1947, a stamp was issued which shows the fields of Ploesti. Two other stamps show oil wells and a refinery. One of three that were issued to publicize Labor Day, May 1, 1948, shows several oil wells. Two air mail stamps, both showing wells, were issued in 1948.

Other Romanian oil issues include oil wells to publicize the Exposition of Industrial Techniques, a set of four to publicize the 1951-55 Five Year Plan, and a set of three to commemorate the Peoples Republic in the Spring of 1953.

There is an oil well in the Coat of Arms issues of 1949-52. A stamp issued in 1954 shows a chemical plant and oil wells. Romania issued three stamps in 1957 to commemorate the centenary of the Romanian industry: one showing an oil field with derricks and a refinery, and another a horse pulling a drill in 1857.

Bulgaria issued a set of five large stamps in 1947 to commemorate the 40th anniversary of the Communist Revolution. The highest denomination in this set, a dark green stamp, shows an oil refinery.

Two stamps were issued in 1954 to commemorate the fifth anniversary of the death of George Dimitrov, a Bulgarian chemist. The 80s brown stamp pictures Dimitrov and an oil refinery.

One of a set of six issued in 1954 to commemorate the 10th anniversary of Bulgaria's liberation, a 28 s indigo stamp, shows a refinery.

OIL STAMP CHECK LIST

Readers who are interested can obtain a complete check list of all the oil stamps issued to date. Address requests to: The Editor, World Petroleum, 604 Fifth Avenue, New York 20, N. Y.

CENTRAL EUROPE

Austria issued eight in 1947 to commemorate the Vienna International Fair, one of which shows several oil wells. Another stamp, one of ten issued in 1948, shows tank cars and a refinery.

Czechoslovakia issued four stamps in 1941 to publicize the Prague Fair. Two of these, both of the same design but of different denominations and colors, show a synthetic gasoline plant. To celebrate Miners' Day, 1953, Czechoslovakia issued two stamps, one of which shows an oil field and workers.

Greece issued a set of six stamps in 1958 to honor the Greek merchant marine, and one of them shows an oil tanker.

Italy publicized the Fourth World Petroleum Congress in Rome, June, 1955, with two striking stamps. The 25-lira stamp shows an oil well and an old Roman aqueduct; the 60-lira shows marble columns and an oil field on a globe.

WESTERN EUROPE

France issued in 1955 a 6-franc carmine lake Bordeaux stamp, a beautiful design showing an oil well. In 1957, a stamp was issued of the same design but in different colors. In May of this year, one of four new French industrial stamps shows a drill-

ing rig and an oil field map of the Sahara region.

AFRICA

Italian Somaliland issued two air mail stamps in 1957 to publicize the fourth Somali Fair and Film Festival, one showing a modern drilling rig.

United Arab Republic in Cairo on April 16, 1959, issued a 10-mil blue stamp to commemorate the First Arab Petroleum Congress. The central part of the design is a circle in which is a map of the Arab world's producing regions and an oil pipeline, with a derrick rising out of the circle toward the top of the stamp.

The UAR for Egypt: On July 23, 1958, the United Arab Republic issued for Egypt a set of five industry stamps. They are of various designs and denominations, and are printed in one sheet of 25 in vertical rows of five. The fourth stamp in the row is a 10-mill olive-green stamp showing a derrick and a refinery.

LATIN AMERICA

Argentina issued a striking 50-centavo stamp in 1936 showing a well on piling in the ocean, in the Comodora Rivadavia field. This field, discovered in 1907 on the Atlantic coast, is the country's largest and most important.

A 40-centavo, bright-blue, recess-engraved stamp issued in December, 1957, shows three rays in the national colors emanating from the top of a derrick and terminating in a pair of cupped hands filled with crude petroleum.

Bolivia—in 1938 issued a 10-centavo, pink stamp showing several wells and part of a refinery. A 45-centavo, rose-red stamp in 1938 shows the Sucre-Camiri railway, constructed to the oil field at Camiri where a small refinery was in operation. Close examination of this stamp discloses a small locomotive in the upper left corner and an oil well in the lower right corner.

In 1955, Bolivia issued a set of five ordinary and five air mail stamps; the former showing an oil refinery and the latter two oil wells.

Brazil: Although drilling for oil in Brazil did not commence until October, 1939, this country issued a set of four oil stamps in the latter part of 1941. Small in size, of different denominations and colors, but all the same design, they show a group of oil wells.

The popularity of this design, or the desire of Brazil to publicize the oil industry, is indicated by the 13 stamps of the same design issued since 1941.

In October, 1958, Brazil issued a blue stamp to commemorate the Fifth anniversary of President Getulio D. Vargas' oil law, by which the entire petroleum industry except marketing and some refining was made a monopoly under government ownership. The design shows a large head of Vargas, a large right hand, and an oil well in the background.

Chile issued in 1956 a 10-peso, bluish-green stamp showing three wells and an airplane.

Colombia has issued 12 oil stamps, seven of which are ordinary postage, three of which are air mail, of three different designs. The first shows a group of wells and storage tanks, the second several wells, and the third two wells, a palm tree, and steel storage tanks. In 1956, the dark-green and black, 50-centavo denomination shows the Catatumbo oil field near the Venezuelan border.

Curacao: Off the coast of Venezuela is the Dutch island of Curacao, where part of the oil Venezuela produces is refined. In 1934, Netherlands issued a stamp commemorating the Tercentenary of Curacao. It shows oil tankers, storage tanks, and the refinery in Willemstad harbor. Two stamps were issued by Curacao to publicize the 21st meeting of the Caribbean Commission at Aruba in December, 1955, one of which a blue and emerald triangular stamp, pictures the Aruba refinery.

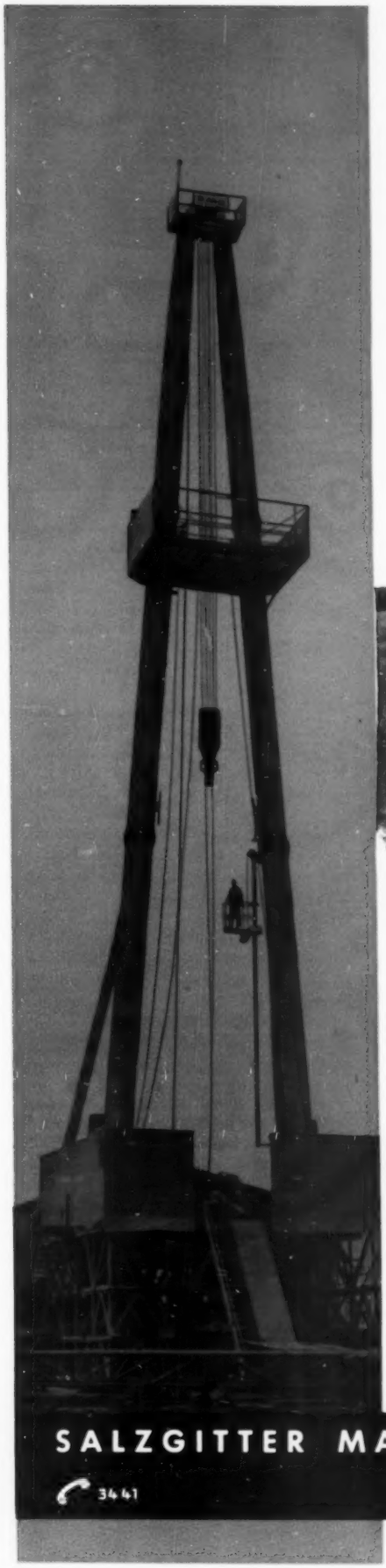
Guatemala has no production, transportation, or refining. Activities are confined to exploration and marketing. It was surprising, therefore, when in 1956 a 3-centavo sepia, engraved stamp was issued showing three wells and a pipeline with oil flowing from it. A revolution early in 1954 resulted in a new government favorable to investment by foreign companies and the enactment of a new petroleum code; and this was a propaganda stamp to that action.

Mexico has been a crude oil producer since 1901. However, it did not issue a stamp pertaining to oil until 1958. The stamps are a set of four, issued to commemorate the 20th anniversary of the expropriation of foreign oil companies' properties in March, 1938. The designs relate to various phases of oil production.

Other Mexican issues pertaining to oil were not true postage stamps. The 5-peso stamp of the 1937 Internal Revenue set includes an oil well. A 1940 series showed the Mexican eagle on an oil well, with a gushing well in the background. Ten federal tax stamps in 1940 and 13 internal revenue stamps in 1941 all involved variations of designs that included oil wells.

Peru, the oldest oil producing country in South America, issued a small, green, 4 centavo stamp in 1931 showing a gushing well. Two large, 4-centavo stamps of the same design were issued in 1936 and 1937. The well shown is a gusher at Talara, a producing area near the Pacific coast in the northwestern part of Peru.

Trinidad and Tobago: About six miles



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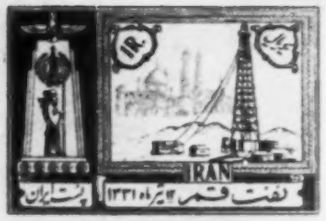


off the northeast coast of Venezuela is Trinidad, an island in the British West Indies. Discovered by Columbus in 1496, this island has the largest commercial asphalt deposit in the world and is one of the most important oil producers in the British Empire.

In 1935, the colony of Trinidad and Tobago issued a set of nine stamps showing various scenes and buildings on the islands. Along the left border on each stamp is a derrick, and at the bottom of the design are these words: "Discovery of Lake Asphalt by Raleigh 1595".

From 1938 to 1941, a set of 11 stamps was issued: the 6-cent denomination of which shows the same inscription about Lake Asphalt and two oil wells along the left side. The design was repeated, with a small variation, in another later issue of the 6-cent stamp; and repeated with another variation in a set of ten stamps in 1953.

Venezuela has issued 79 oil stamps, almost as many as Romania. There are 15 air stamps of the same design, showing a modern airplane flying over several wells in Lake Maracaibo. Stamps with designs pertaining to oil were issued for four Venezuelan states in 1951, using an oil well in the design. In the same year, seven ordinary and nine air mail issues of the same design showed the Arms of Anzoategui, a well, a globe, and a tanker. In 1953, seven ordinary and nine air mails were issued showing a map of Delta Amacuro, the Amacuro oil field and a ship; and seven ordinary and nine air mails were issued showing the Arms of Falcon and a stylized oil refinery.

NORTH AMERICA

Canada publicized the extensive exploration and development program in Alberta which followed the 1947 Leduc field discovery by a very nice 50-cent stamp issued in 1950. Green in color, the stamp shows storage tanks and two wells, one with a large gas flare.

A 5-cent stamp of unusual design was issued in 1953 to commemorate the 50th anniversary of the founding of Alberta and Saskatchewan provinces. The design shows pioneer settlers, a wheat field and three oil wells.

In commemoration of its oil industry centennial, Canada issued a 5-cent stamp in September 1958, showing a kerosine lamp and an oil refinery. The stamp is a tribute to the country's oil industry and calls attention to the important role played by Canadians in the development of petroleum. Canadians point out, for example, that Abraham Gesner, a Nova Scotia geologist, laid the foundation for the oil industry when he discovered kerosine in 1846 and established its use for illuminating purposes; and that another Canadian, James M. Williams, dug the first commercially successful oil well at Oil Springs, Ontario, in 1857.

The United States, largest oil producing country, issued its own first true oil stamp on August 27 of this year, in commemoration of the USA oil industry's centennial. According to the Post Office Department, the stamp commemorates "the 100th anniversary of the discovery of the first artesian oil well in America".

Paul S. Hedrick, stamp editor of the *Tulsa World*, probably expressed the opinion of most oil men, and topical stamp collectors too, when he wrote in his column:

"The official release of the design. . . . pictures a tall rotary derrick, and carries the simple marking '1859-1959 Petroleum Industry'.

"Somehow or other, all reference to Drake's discovery well was omitted from the stamp, color of which will be a dark orange or gold, indicative of the appellation 'Black Gold.'

"More than 100 suggested designs were studied by the Post Office Department and a design from an unknown artist, taken from an oil well supply catalog, was chosen.

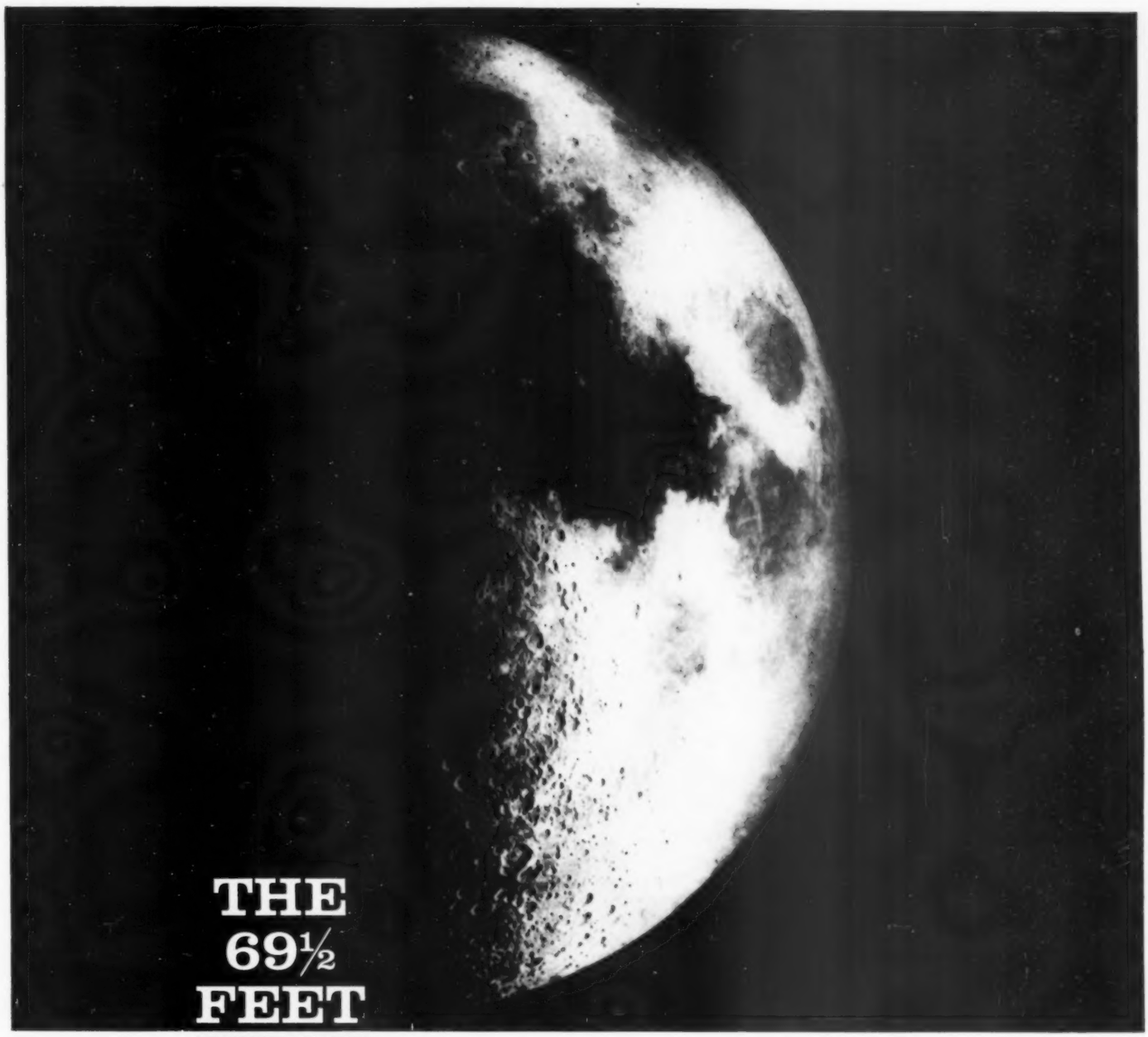
"Disappointment is expressed by scores of oil men who have viewed the picture of the stamp."

The wording "U. S. Postage" appears across the upper portion of the design, with "1859" and "1959" somewhat below, divided by the oil derrick. Extending from left to right in the lower portion of the design in U-shaped form is the identifying inscription and the denomination: "Petroleum Industry." Uninspired but commemorative after all.

Two other stamps have been issued in which oil is featured. The 3-cent yellow stamp of 1950 in commemoration of the centennial of the admission of California to statehood shows the tops of two oil wells in the upper right corner. A 3-cent stamp issued in 1951 to commemorate the 75th anniversary of the formation of the American Chemical Society shows a catalytic cracking unit, a butadiene reactor, and a fractionating unit.

One other which is included in some collectors' albums is the Oklahoma State cigarette tax stamp of 1939, which shows three oil wells.

Some of the 423 oil stamps issued by 36 countries as of August 1, 1959, are not easily obtained, and some are expensive. Many of them are parts of sets. In order to know when individual oil stamps are issued, one must study carefully the designs of all new issues from all the oil producing countries of the world. Oil stamps make an interesting and attractive topical collection which gives pleasure and knowledge to thousands of oil men and other hobbyists who collect them. END



THE 69½ FEET THAT REACH THE MOON

Time: One hundred years ago—1859.

Place: Titusville, Pennsylvania.

Event: The first U. S. oil well "came in" at 69½ feet. And from it and its successors have come endless miracles of oil.

Today, petroleum gives us fuels that are capable of moving man from earth to the moon and beyond. Such explorations can bring new knowledge of incalculable value.

But no less certain than the conquest of space is that we will have ever better fuels and lubricants for travel on the ground, on the sea, and in the air—new and exciting products for the farm, industry and the home.

Today it is estimated that one quarter of all the money spent by U. S. industry on research is spent by the petroleum industry.

And as chemists study the endless ways to rearrange oil molecules to make useful products, we can see that the age of petroleum has only begun.

Standard Oil Company (New Jersey) Esso

A new low cost treating process

Combination of mercaptan extraction and sweetening, the new UOP Merox catalytic process can be applied to straight run and cracked gasolines, jet fuels, and other middle distillates.

by K. M. Brown, W. K. T. Gleim, and P. Urban†

THERE HAS long been a need for an inexpensive method of treating gasolines of the type that are not quite sour enough to economically justify the cost of a Unisol mercaptan extraction unit, but which cannot be sufficiently reduced in mercaptan by simple regenerative caustic washing to yield a doctor sweet product. Also, there is a need for an inexpensive means of treating jet fuels, kerosines and other middle distillates.

The new UOP Merox* process fills this need, and further it avoids the inherent disadvantages of conventional copper sweetening, or doctor (Plumbite) sweetening. The Merox process performs the dual function of extracting easily removed mercaptans and converting the remaining mercaptans to disulfides, thereby yielding a doctor sweet product.

The Merox process is a combination of mercaptan extraction (Fig. 1) and sweetening (Fig. 2). Either of these functions can be carried out independently when desired. The process can operate as a mercaptan extractor only and as such is referred to herein as Merox extraction. When operated to sweeten only, that is, to convert mercaptans to disulfides, it is referred to as Merox sweetening.

The combination operation is applicable to all gasoline and lighter boiling range materials, and the sweetening step is applicable to many jet fuels and kerosines. The process was developed in the research laboratories of Universal Oil Products Co. and is available under license to the refining industry.

The Merox process accomplishes its dual function through the use of a catalyst, with a high degree of activity in promoting direct oxidation of mercaptans to disulfides at ambient temperatures using atmospheric oxygen according to the following overall reaction:

$$RSH + \tfrac{1}{4}\,O_2 \rightarrow \tfrac{1}{2}\,RSSR + \tfrac{1}{2}\,H_2O \quad (1)$$

Mercaptan Extraction. In the extraction application, the mercaptans are extracted by caustic soda, forming a weak chemical combination with the sodium hydroxide as follows:

$$\underset{\text{(oil)}}{RSH} + NaOH \rightleftharpoons \underset{\text{(aqueous)}}{NaSR} + H_2O \quad (2)$$

Reaction (2) is reversible and, therefore, it is not possible to get complete mercaptan removal by extraction alone without use of an excessive amount of caustic soda solution. The principles of mercaptan extraction have been thoroughly covered in the literature.[5,12,19] In general, the conditions favoring the forward reaction are: (1) low temperature, (2) low molecular weight of the mercaptan being extracted, and (3) high caustic concentration.

The forward reaction is also favored by the use of compounds which increase the solubility of mercaptan ions in the aqueous phase.[20] Of these, methanol as used in the Unisol process is by far the most effective.[2,4,7,11,13,20] Others (that have been used commercially) are isobutyric acid and petroleum cresols.[5,20,21] As with other mercaptan extraction processes, these solubilizing agents are effective in Merox extraction.

In conventional mercaptan extraction the caustic is regenerated by stripping with steam at the boiling point of the caustic solution. The high temperature favors the reversal of reaction (2), the steam vaporizing the mercaptan released by this reversal and removing it from the reaction site.

In the Merox process the caustic is regenerated, after separating it from the hydrocarbons by blowing it with a small quantity of air at ambient temperature. The regeneration reaction proceeds as follows:

$$NaSR + \tfrac{1}{4}\,O_2 + \tfrac{1}{2}\,H_2O \rightarrow \tfrac{1}{2}\,RSSR + NaOH \quad (3)$$

The disulfides formed in this reaction are insoluble in the caustic solution and can be removed in a gravity separator. After separation of the disulfides, the caustic is suitable for reuse. It will be seen that regeneration is not simply the reversal of the extraction reaction; therefore, high temperature and expensive stripping steam are not needed.

The Merox catalyst may be in solution in the caustic or it may be held on a suitable support when greater activity is needed. If it is in solution, the caustic is regenerated by bringing it into intimate contact with air in a suitable reactor which may be an orifice column, a mechanically stirred reactor, or other gas-liquid contactor. If the catalyst is supported on a carrier, the caustic is regenerated by passing it together with air over a packed bed.

Mercaptan Sweetening. Sweetening is defined as converting mercaptans to disulfides, with the disulfides remaining in the oil. There is no change in sulfur content of the oil during sweetening. To carry out Merox

†All of Universal Oil Products Co., Des Plaines, Ill. Mr. Brown is manager of the treating department; Dr. Gleim is a research coordinator in the chemical research department; and Mr. Urban assists Mr. Gleim in work on refining problems.

* Trademark

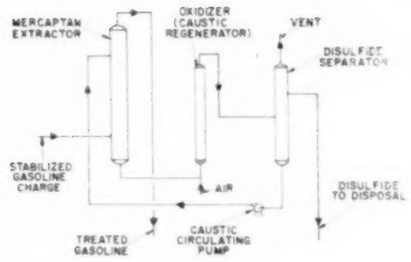


Fig. 1—Schematic flow of Merox mercaptan extraction process.

sweetening, air is introduced to a caustic-hydrocarbon mixture. The disulfides formed, as in Equation (3), dissolve in the oil being treated. Again, the catalyst may be in solution in the caustic or it may be held on a suitable carrier when higher activity is needed. When it is in solution, the caustic, hydrocarbon and air are intimately mixed in an orifice plate column, or in a stirred reactor or other liquid-liquid contacting device. When held on a support, the caustic, gasoline and air are passed over a packed bed of catalyst.

Both of these functions can be carried out by a combination of the operations shown in Figs. 1 and 2. Fig. 1 illustrates the case in which the Merox catalyst is dissolved in the caustic soda solution. Oxygen-free gasoline is fed to the bottom of a vertical extractor and flows upward countercurrent to the downward flow of caustic which contains the Merox catalyst. Those mercaptans that are easy to extract will be removed by the caustic in the extraction zone.

The rich caustic from the bottom of the extractor is mixed with air in the oxidizer. Disulfides formed in the oxidizer and excess air are separated from the caustic in the disulfide separator. Regenerated caustic from the disulfide separator is recirculated to the top of the extractor. Disulfides are withdrawn from the separator to disposal, and the excess air is vented.

In some applications sufficient mercaptan removal can be accomplished by extraction alone without use of the sweetening feature.

Catalyst life, without measurable decline of activity, was in excess of 20,000 bbl/lb of catalyst, in the pilot plant development of the process using dissolved catalyst. Catalyst life for commercial units using the dissolved catalyst has exceeded this figure. Based on the above life, the cost of catalyst will be less than 0.1¢ per barrel treated.

Pilot Plant Investigations. A great variety of gasolines, jet fuels and kerosines have been treated in a small pilot plant. The laboratory-pilot plant investigation of a gasoline sample involves: (1) determination of the amount of mercaptan that can be extracted by caustic soda, and (2) determination of suitable conditions for sweetening. Only Step 2 is investigated in the pilot plant proper because the theoretical and practical basis of extraction design is well established. However, laboratory extraction of the mercaptans is carried out to determine the extent to which mercaptans can be removed by extraction, and the tetraethyl lead susceptibility improvement that results from extraction of mercaptans.[9,10,16]

Investigations of jet fuels and kerosines did not involve mercaptan extraction; only the sweetening step was employed.

Table 1 gives the pilot plant results of gasoline treatment. Pilot plant experience to date indicates that all stocks in the gasoline boiling range or lower can be readily sweetened with either the dissolved or the solid catalyst. Data on stability properties of the pilot plant treated gasolines are incomplete, and are not included herein. Commercial experience has demonstrated that the stability of the gasoline is equal or better than that obtained by other methods of treating.

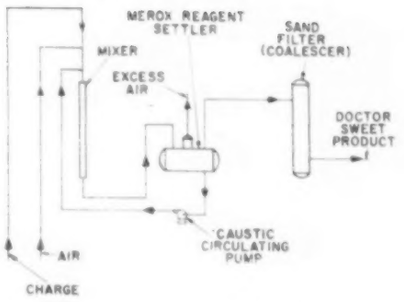


Fig. 2—Schematic flow of Merox mercaptan sweetening process.

Higher boiling stocks are more difficult to sweeten and may require the use of the more active solid catalyst. Table 2 gives the before and after properties of some jet fuels and kerosines sweetened in the pilot plant.

TABLE 1—MEROX SWEETENING OF CRACKED AND STRAIGHT RUN GASOLINES

Sample and Crude Source	Cat. Cracked Gaso. Wyoming Oregon Crude		Cat. Cracked Wyoming Pipe Line Crude		Lt. S. R. & Vis-Breaker Gaso. Wyo. Pipeline Crude	
	Raw	Trtd.	Raw	Trtd.	Raw	Trtd.
Doctor Test	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.
Mercaptan Sulfur, wt %	0.022	<0.0003	0.0144	0.0009	0.0319	0.0004
Hydrogen Sulfide, wt %	0.0	0.0	0.0	0.0	—	—
Total Sulfur, wt %	—	—	—	—	—	—
Induction Period (UOP Bomb)						
Min.	—	>1130*	85	50	40	75
+0.002% UOP No. 5 Inhib.	—	—	—	190	—	675
+0.004%	—	—	—	300	—	900
API Gravity	55.8	—	60.6	—	78.2	—
Distillation:						
IBP F.	115	—	110	—	86	—
10%	141	—	138	—	106	—
50%	224	—	204	—	147	—
90%	369	—	293	—	208	—
EP	445	—	332	—	271	—
Sweetening Cond:						
Temp. F.	—	100	—	104	—	104
Pressure, psig	—	Atm.	—	100	—	100
Catalyst type	—	Dissolved	—	Dissolved	—	Solid

	Visbreaker Gaso. Wyoming Pipeline Crude		Lt. S. R. Gasoline Mid-Continent Crude			T. C. & S. R. Rocky Mountain Crude		T. C. & S. R. Kentucky Crude	
	Raw	Trtd.	Raw	Trtd.	Trtd.	Raw	Trtd.	Raw	Trtd.
Doctor Test	Pos.	Neg.	Pos.	Neg.		Pos.	Neg.	Pos.	Neg.
Mercaptan Sulfur, wt %	0.0644	<0.0002	0.0025	<0.0002	<0.0002	0.026	0.0003	0.01	0.0006
Hydrogen Sulfide, wt %	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Total Sulfur, wt %	—	—	0.014	—		—	—	—	—
Induction Period (UOP Bomb), Min.						965**		1055**	455**
+0.002% UOP No. 5 Inhibitor									
+0.004% UOP No. 5 Inhibitor									
API Gravity	68.3	—	75.9	—		65.6	—	65.5	—
Distillation:									
IBP F.	88	—	105	—		89	—	90	—
10%	131	—	124	—		118	—	122	—
50%	210	—	159	—		198	—	203	—
90%	275	—	200	—		334	—	340	—
EP	308	—	238	—		390	—	393	—
Sweetening Cond:									
Temp., F.	—	104	—	104	75	—	104	—	104
Pressure, psig	—	100	—	100	100	—	100	—	100
Catalyst Type	—	Solid	—	Solid	Solid	—	Solid	—	Solid

* As received sample contained inhibitor that was not extractable with caustic.
** As received sample contained caustic extractable inhibitor.

TABLE 2—MEROX SWEETENING OF JET FUELS, JET FUEL COMPONENTS, KEROSENE AND GAS OIL

Sample and Source	JP-4 (S.R. Naphtha) Inter-Provincial Pipeline Crude		JP-4 (S.R. Naphtha) Wyoming Pipeline Crude		JP-4 (S.R. Naphtha) Kuwait Crude		Kerosine Rocky Mountain Crude		Virgin Gas Oil Gulf Coast Sour Crude	
	Raw	Trtd.	Raw	Trtd.	Raw	Trtd.	Raw	Trtd.	Raw	Trtd.
Doctor Test	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.
Mercaptan Sulfur, wt %	0.0156	0.0002	0.0220	0.0003	0.0132	<0.0001	0.0068	0.0003	0.0404	0.008
Color	—	25	25	14	19	18	29	19	—	—
Color after 20 hrs. @ 212 F.	—	21	23	14	17	16	19	19	—	—
Water Tolerance Test	1	1	1	1	1	1-B	—	—	—	—
Thermal Stability (CFR Coker Test)										
ΔP Rise after 300 min., in. Hg	0	0.2	0.1	1.7	0.5	0.5	—	—	—	—
Tube Rating, Max.	1	1	1	1	1	1	—	—	—	—
API Gravity	54.3	—	54.8	—	56.1	—	42.1	—	37.1	—
Distillation:										
IBP, F.	148	—	139	—	148	—	372	—	424	—
10%	212	—	184	—	208	—	398	—	444	—
50%	295	—	307	—	289	—	436	—	486	—
90%	350	—	398	—	420	—	475	—	575	—
EP	390	—	432	—	484	—	500	—	615	—
Sweetening Conditions:										
Temp., F.	—	104	—	104	—	104	—	104	—	117
Pressure, psig	—	100	—	100	—	100	—	100	—	100
Catalyst type	—	Solid	—	Solid	—	Solid	—	Solid	—	Solid

and one gas oil which is being commercial treated. The high boiling gas oil shows considerable mercaptan removal although not to the level of negative doctor test.

Of particular interest in the case of the jet fuels is whether or not the process has any harmful effect on the CFR Fuel Coker Test[14] and water tolerance test.[15] As reported in Table 2, there appears to be no harmful effect.

Copper and doctor (sodium plumbite) sweetening often have a seriously detrimental effect on the coker test and also on the water tolerance test. Doctor treating often results in failure to pass the copper strip corrosion test. From a consideration of the mechanism through which the Merox process sweetens as compared to the mechanism of doctor or copper sweetening, there seems to be little fear that Merox sweetening can harm the properties of jet fuel.

In both copper and doctor sweetening, the reaction to form disulfides takes place in the oil phase. Certain products of incomplete reactions, and side reactions, are consequently left in the oil and their presence may affect the thermal stability and water tolerance of the fuel.

Without going into the elaborate detail of a very complex series of reactions,[10] doctor sweetening proceeds in general according to the following reactions:

$$2\ RSH + Na_2PbO_2 \rightarrow Pb(SR)_2 + 2NaOH \quad (4)$$

$$2\ Pb(SR)_2 + xS \rightarrow RSSR + RSxR + 2PbS \quad (5)$$

$$Pb(SR)_2 + \tfrac{1}{2}\ O_2 \rightarrow RSSR + PbO \quad (6)$$

The lead mercaptide formed, Equation (4), is oil soluble. The sulfur added, Equation (5), is oil soluble. The use of excess sulfur over the stoichiometric requirement is a necessity, to get complete disappearance of oil-soluble lead mercaptide. A very delicate control of excess sulfur is needed. Too much sulfur will cause excessive formation of polysulfides as in Equation (5). Also, it will give a product that is corrosive by the copper strip test. In the case of jet fuel the control of sulfur addition is much more critical than has been the case in treatment of ordinary gasolines and kerosines because of the more severe corrosion test (2 hrs. at 212 F.) specified, [1] and the fact that polysulfides, which result from excess sulfur, may cause failure in the coker test.

If insufficient sulfur is added, lead mercaptide remains in the oil and when this subsequently oxidizes in the storage tank, very finely divided particles of lead oxide will form, equation (6). This fine suspension of solids tends to stabilize emulsions and causes failure to pass the water tolerance test.

Copper sweetening is generally considered to proceed according to the following reactions:[8]

$$4\ RSH + 2\ CuCl_2 \rightarrow 2\ Cu(SR) + 4\ HCl + RSSR \quad (7)$$

$$RSH + CuCl \rightarrow CuSR + HCl \quad (8)$$

$$2\ CuSR + 2\ CuCl_2 \rightarrow RSSR + 4\ CuCl \quad (9)$$

$$2\ CuSR + O_2 \rightarrow 2\ CuO + RSSR \quad (10)$$

In copper treating it is a practical impossibility to prevent some oil-soluble cuprous mercaptide from remaining in the treated oil. Further, copper chloride reacts with naphthenic acids, phenols and other oil-soluble polar compounds to form oil-soluble copper compounds.[9]

The presence of oil-soluble copper compounds has been clearly demonstrated in the UOP laboratories as being responsible for

TABLE 3—PROPERTIES OF NEW MEXICO JET FUEL

API Gravity	49.6
Distillation:	
IBP, F.	153
10%	230
50%	332
90%	425
EP	460
Hydrogen Sulfide, %	Nil
Mercaptan Sulfur, %	0.0524
Total Sulfur, %	0.149
Color, Saybolt	21
Color after 16 hrs. @ 212 F.	<−16
Peroxide Number	1.7

TABLE 4—EFFECT OF CHARGE RATE IN MEROX TREATMENT OF NEW MEXICO JET FUEL ON SOLID CATALYST

Total Hours On Stream	Relative Charge Rate	Percent RSH Sulfur	Doctor Test
8	4	0.0013	Positive
24	4	0.0018	Positive
32	1	0.0004	Negative
44	1	0.00018	Negative
49	1	0.00018	Negative
8	2	0.00052	Borderline
16	2	0.00044	Borderline
31	3	0.00080	Positive
39	3	0.00084	Positive
51	3	0.00080	Positive
69	3	0.00080	Positive
80	3	0.00087	Positive
86	3	0.00087	Positive
11	3	0.00088	Positive
17	3	0.00084	Positive
40	3	0.00090	Positive
65	3	0.00087	Positive
87	3	0.00090	Positive

TABLE 5—PROPERTIES OF MEROX TREATED JET FUEL FROM NEW MEXICO CRUDE

	As Received	Laboratory Copper Sweetened	Pilot Plant Merox Treated
Mercaptan Sulfur, %	0.0524	Sweet	Sweet
Color, Saybolt	21	3	12
Color, Saybolt After 20 Hrs. @ 212 F.	Below −16	Below −16	−15
Water Tolerance Test	1	1	1
CFR Fuel Coker Test Press. Drop Rise after 300 Min., in Hg	0.2	0.7	0.8
Tube Rating, Max.	1	1	1

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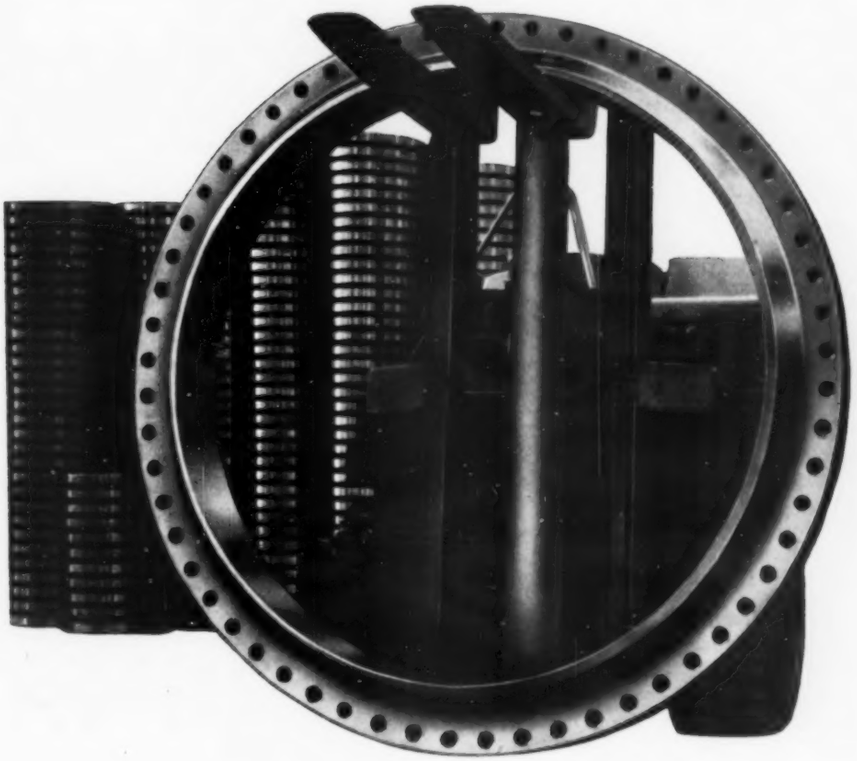

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the failure of jet fuel to pass the CFR Fuel Coker Test. When oil-soluble cuprous mercaptide is left in the oil due to incomplete reaction, Equations (7) and (8), it will subsequently oxidize, Equation (10), to give very finely divided copper oxide which, as in the analogous case of lead oxide, can stabilize emulsions and cause failure to pass the water tolerance test.

By contrast, the Merox catalyst is insoluble in the oil, and only those mercaptans which enter the aqueous phase will be oxidized. Accordingly, only those materials which enter the aqueous phase could undergo side reactions, and only those side reactions which result in formation of oil soluble products could give rise to any harmful effects. So far, such side reactions have not been observed and it is considered unlikely that the Merox process can harm the stock and cause it to fail the coker thermal stability test.

It is of interest to consider in greater detail a jet fuel from New Mexico crude that offered considerable resistance to sweetening. The properties of this stock are given in Table 3.

The stock was treated at 75 F. and atmospheric pressure through a bed of solid catalyst and the results are shown in Table 4. These results warranted the preparation of sufficient treated products for thermal stability evaluation using the CFR Fuel Coker Test.[11]

The mercaptans were reduced sufficiently to meet the specification of 0.001% mercaptan sulfur at a treating rate three times greater than the rate needed to make a doctor sweet product. A mercaptan sulfur content of 0.0004 to 0.0005 appeared to be the borderline between a positive and negative doctor test.

The results of CFR Fuel Coker Tests are shown in Table 5, which also shows the coker test results on the same sample after laboratory copper sweetening. Laboratory copper sweetening was carried out under very carefully controlled conditions so as to minimize the amount of copper present in the jet fuel. This same jet fuel in commercial copper sweetening operation had consistently failed to pass the coker test until substantial additions were made to the plant to remove copper from the treated stock.

The color and color stability of this jet fuel as received, after copper treating and after Merox treating is also given in Table 5. It is obvious that the stock is highly color unstable. With such a stock it is not unexpected that contacting with air and an oxidation catalyst causes serious color loss. The loss of color and color stability in copper treating even under carefully controlled laboratory conditions is considerably greater than for the Merox treated stock, which in the 20-hr. exposure test, still remains within the Saybolt color scale.

Commercial Applications. An advantage of the process that will be of particular interest to economy-minded plant managers is the low cost of converting existing treating equipment for use in the Merox process. In Table 2 results of laboratory treating a gas oil are given. This particular gas oil also is being commercially treated. Treatment of this gas oil is considered to be a special case. In this particular case the refiner was interested in removing only 25% of the mercaptans present. He had been employing hypochlorite sweetening to accomplish this degree of removal. Hypochlorite was not entirely satisfactory and the chemical costs were quite high. Merox treating in a plant hastily improvised from existing equipment was able to convert 25% of the mercaptans at a considerably lower cost than hypochlorite sweetening.

Unlike copper or doctor treating, Merox can effect a partial reduction of mercaptan without leaving harmful products of incomplete reaction, (oil soluble mercaptides) in solution in the oil. A comparison of hypochlorite and Merox operating costs for this stock is given in Table 6.

A commercial Merox extractor and sweetener is currently in successful operation employing a converted steam regenerated caustic scrubber and copper sweetening unit. Original equipment included eight vertical and two horizontal vessels, caustic circulating pump, gasoline booster pump and stress-relieved heat exchange equipment including a caustic heater, cooler and exchanger. The Merox unit converted from this equipment makes use of only five vertical and two horizontal vessels. Heat exchange equipment was completely eliminated, as were the three copper sweetening unit reagent towers.

The only addition to the existing plant was a disulfide separator, also an existing vessel. The other simple changes were in piping to introduce air into the regenerator through the existing steam inlet, and into the bottom of the water washer through the drain line. The water wash vessel was converted to serve as the Merox sweetener.

The results of Merox extraction and sweetening in this commercial unit have exceeded results obtained when using steam stripping and copper sweetening from the very beginning of the operation as shown in Table 7. Table 8 gives the properties of the treated gasoline.

A commercial plant is in operation using solid Merox catalyst to treat thermally cracked gasoline. This plant was converted from a steam stripped caustic mercaptan extractor plus a copper sweetening plant to Merox extraction plus Merox sweetening. The operation has been successful from the outset. Table 9 gives some results.

Reliable operating cost data are not yet available for this solid catalyst unit. It is expected that Merox catalyst cost will be less than 0.25¢/bbl, but it will be several months before catalyst life figures are available. Other operating costs are much lower

TABLE 6—CHEMICAL COST OF MEROX TREATMENT

To Convert 25% of the Mercaptans in a Sour Gulf Coast No. 2 Distillate Containing 0.04 percent Mercaptan Sulfur

Treating Rate, b/d	2,600
Chemicals:	
Initial Charge:	
Caustic Soda, 261 lb.	$7.83
Merox Catalyst, 0.42 lb.	5.25
Added during 21 operating days:*	
Caustic Soda, none	—
Merox Catalyst, 0.58 lb.	7.25
Total Chemicals for treatment of 54,600 barrels	$20.33
Chemical Cost, cents/barrel	0.037
Catalyst life to date: 54,600/1.0 = 54,600 bbl./lb.	

* Merox solution was still useful.

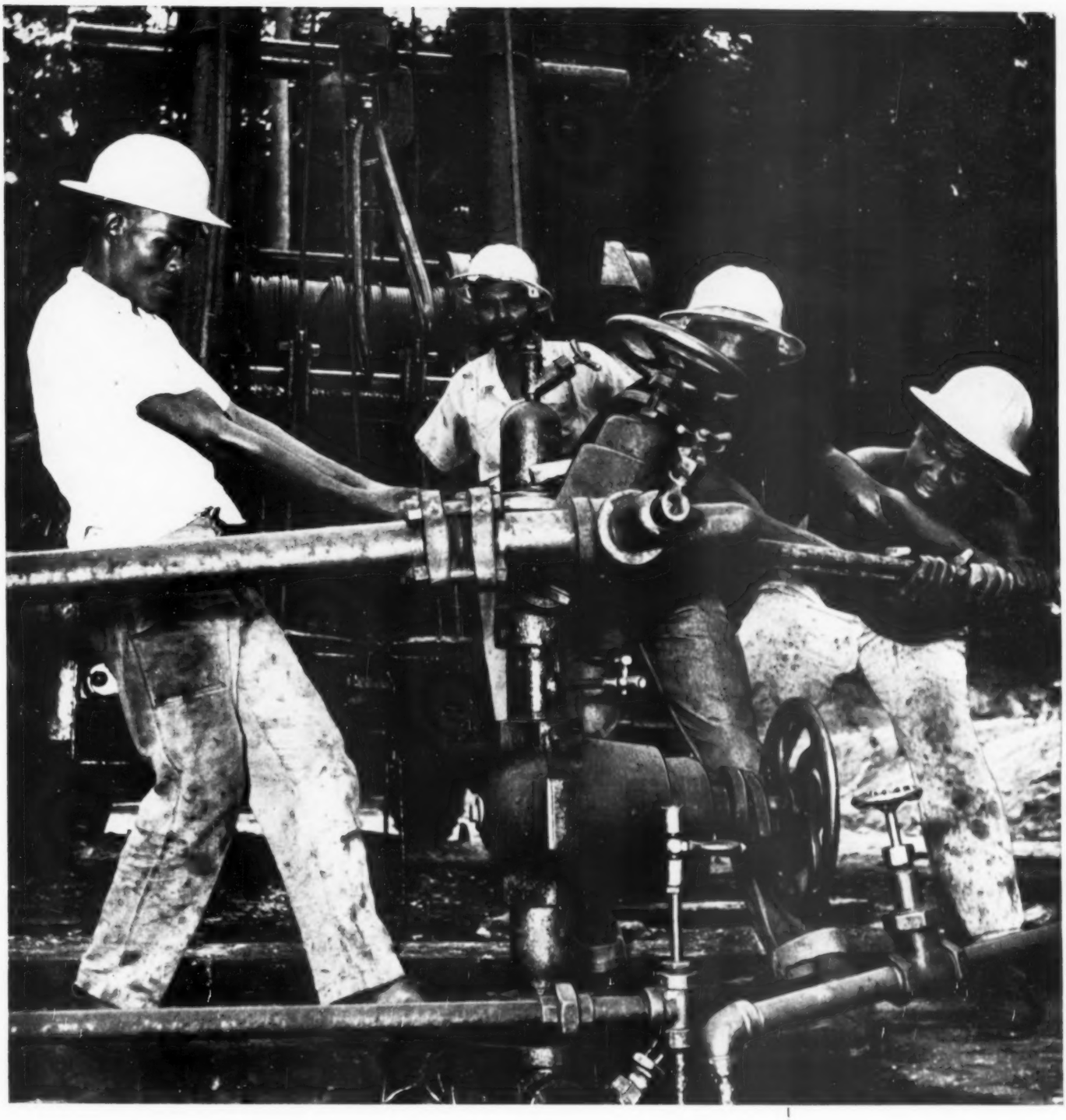
Note: To sweeten the same amount of stock with sodium hypochlorite would have consumed 174,000 gallons of hypochlorite solution made up of:

Caustic Soda	29,300 lb. @ 3¢/lb.	= $879.00
Chlorine	7,280 lb. @ 3¢/lb.	= 218.00
Water	1,420,000 lb.	—
		$1,097.00
Chemical cost, cents/barrel		2.01

TABLE 7—COMPARISON OF COMMERCIAL RESULTS—GASOLINE TREATING

		Former Operation		Merox Process	
	Raw Gasoline	RSH Extract. (steam regen.)	Copper Sweet.	Mercaptan Extract.[1]	Sweet.
Gasoline Charged, b/d	525				
Mercaptan Content, % S:					
Raw Gasoline	0.06				
After Mercaptan Extr.		0.017-0.024		0.011-0.017	
After Sweetener			Swt.		Swt.
Regenerated Caustic		0.25-0.35		0.02	
Operating Cost Comparison:					
Power: same both cases					
Caustic Consumption, ¢/bbl.		Equal	None	Equal	0.12
Catalyst, ¢/bbl.		—	2.58	0.05[1]	0.06[2]
Air, ¢/bbl.		—	0.05	0.022[3]	—
Steam, ¢/bbl.		3.6	—	—	—
Operating Labor		Equal	Equal	Equal	Equal
Maintenance (changing catalyst)		—	1.50	—	—
Total	—	3.6	4.13	0.072	0.18
Combined cost—both operations:		7.73		0.252	
Savings to refinery by Merox, ¢/bbl. (exclusive of royalty)				7.48	

[1] Initial catalyst charge—no make up required to time of study.
[2] Initial charge plus weekly make up of 25 to 50 grams.
[3] Use of existing equipment (oversized for the new service) resulted in poor contact efficiency; therefore, air used was greatly in excess of theoretical requirement.



Trinidad. A production crew carry out service on a wellhead assembly. British Petroleum has a 77% interest in the Trinidad Petroleum Development Company Limited, which last year produced nearly three-quarters of a million tons of oil.

BP

TABLE 8—MEROX TREATMENT OF THERMALLY CRACKED GASOLINE

	Charging Stock	Merox Extracted And Sweetened
Doctor Test	Positive	Negative
Peroxide No., Yule & Wilson	1.31	1.07
Hydrogen Sulfide	<0.0002	<0.0002
Mercaptan Sulfur	0.0386	0.0002
Copper, Mg/L	0.01	0.42*
Color	−10	+5
ASTM Gum, Mg/100 ml	4.6	1.5
Induction Period, Min.		
Without Inhibitor	165	65
+0.01% UOP No. 4 Inhibitor, +0.001% UOP Copper Deactivator	330	265
API Gravity	60.9	61.4
Distillation:		
IBP, F.	87	85
5% Overhead	112	108
10%	127	124
50%	242	242
70%	290	290
90%	349	349
EP	392	391
% Recovered	97.0	97.0
% Bottoms	1.0	1.0
% Loss	2.0	2.0

* The copper in the treated stock is due to pickup from incomplete cleaning of the converted copper treating plant.

than in the previous operation through elimination of about 45 lb of stripping steam per barrel of gasoline, and a cost of about 2¢/bbl for copper sweetening reagent.

In another plant, a pentane cut containing 0.04% mercaptan sulfur is being sweetened in an operation which involves bubbling the pentane, containing slightly more than the stoichiometric air requirement, through a pool of caustic soda containing Merox catalyst in solution. It is of interest to note that prior to the decision to use Merox sweetening, $120,000 had been appropriated to build a steam regenerated caustic scrubber to extract 90% of the mercaptans from this pentane cut. Catalyst life in sweetening the pentane exceeds 20,000 bbl./lb.

The same type of operation as used for treatment of the pentane discussed above is also being carried out in another refinery on a blend of light straight run gasoline and catalytically cracked gasoline containing 0.001% mercaptan sulfur. This stock could not be consistently inhibitor sweetened probably because of limitations in ability to hold temperatures above 80 F. in the storage tank.[21] Although it could have been easily and inexpensively sweetened by most any process, Merox was the only one which could be put into use with no modifications to existing equipment except a means of injecting air and a few grams of catalyst per week.

Summary. The Merox process should find widespread use in treatment of the following classes of products:

(1) Sour propane or butane streams fed to UOP Poly plants or to alkylation units. Extraction would be used for complete removal of mercaptan with Merox regeneration of the caustic. Great economies accrue by elimination of the large amount of steam needed for caustic regeneration by conventional stripping. The air required for Merox regeneration is substantially the same for all mercaptans regardless of molecular weight; whereas, in steam regeneration a great deal more steam is needed to strip mercaptans of low molecular weight.

(2) Sour pentane or hexane streams, which may be extracted or sweetened as the case may be.

(3) Light straight run gasoline boiling below the range of charge stocks to UOP Platforming or other catalytic reforming treatments. To take full advantage of the process, such streams should be extracted and then the residual mercaptans sweetened.

(4) Certain catalytically cracked gasolines which resist the usual inhibitor sweetening treatment.[21]

(5) Thermally cracked gasolines of low mercaptan content which are not sour enough to justify Unisol treatment, and which cannot be sweetened with UOP No. 5 or 5-S Inhibitor. The Merox process can successfully sweeten stocks of high mercaptan content; however, if the mercaptan sulfur exceeds about 0.1% it may be more economical to install a Unisol unit for complete mercaptan removal so as to take full advantage of tetraethyl lead savings due to increased lead susceptibility.

(6) Most jet fuels can be sweetened very economically or, if preferred, reduced sufficiently to meet the specification of 0.001% mercaptan sulfur.

(7) When only partial sweetening is adequate, the Merox process may also be applied to higher boiling stocks in the No. 2 fuel oil range. Usually such stocks need not be doctor sweet and are seldom treated except for improving their stability toward sediment formation and color degradation. There may be, however, an occasional stock which must be sweet or at least have a part of the lower boiling mercaptans removed.

The Merox process, both sweetening and extraction, is carried out at "room" temperature or slightly above. There is no corrosion problem as caustic soda is not corrosive to mild steel and cast iron under these conditions.

Electric power for pumping, a small amount of exhaust steam and about 0.5 to 2 SCF of air per barrel treated, depending on the mercaptan content, are the only utilities used.

The only chemical consumed is caustic soda. Its consumption is not a function of the Merox process but of the hydrogen sulfide and non-mercaptan organic acids present.

Catalyst costs will be in the class of 0.05 to 0.1¢/bbl for the soluble catalyst. When solid catalyst is used, it is expected to be considerably less costly than copper sweetening reagent, but commercial units have not been in existence long enough to develop reliable life data.

Operating labor will be less than 8 manhours per day for most units. Some of the commercial units are running without attention during the afternoon and night shifts, and receive only minimum attention during the day. END

TABLE 9—COMPARISON OF COMMERCIAL TREATING RESULTS WITH THERMALLY CRACKED GASOLINE

		Former Operation		Present Operation	
	Charge	After Steam Regen. Caustic Wash	After Copper Sweetening	After Merox Regen. Caustic Wash	After Merox Sweet.
Mercaptan Sulfur, %					
Gasoline	0.035	0.0068	Dr. Sweet	0.0026	Dr. Swt.
Caustic:					
Rich	—	—	—	0.07	—
Regen.	—	—	—	0.002	—
Induction Period,* Min.	—	—	360	—	480-670
ASTM Gum,** Mg./100 ml.	—	—	—	—	1-2

* Plant inhibited with 20 lb. UOP No. 5 inhibitor and 1 lb. UOP Copper Deactivator per 1000 barrels
** Gum dish not heptane rinsed as per ASTM D 381-58T.

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IN CANADA: G. DIKKERS OF CANADA LIMITED, SCARBOROUGH, ONTARIO

Not the Sahara; this is an oil prospecting team travelling by camel train in the desert-like Tarim Basin, Sinkiang Province.

Ten years' of Red China Oil

by Dr. George Rosu

Modern techniques are working side-by-side with primitive methods and a "people's army" approach to push today's production of 80,000 b/d up to a 1964 target of 800,000 b/d.

THE COMMUNIST regime in Red China has set out to build from scratch an integrated and self-sufficient industrial system, a modern defense industry, and mechanized farming—all at the same time.

These objectives were to be attained by three consecutive five-year plans to run from 1953 to 1967. When gross capital goods output jumped nearly 205% during the first Five-Year Plan, the initial blueprints were thrown aside as absurdly unambitious. It now appears that the original targets set for 1962 will be fulfilled this year or next, and those of the third Five-Year Plan by 1963 or 1964.

This article is concerned with the place and achievements of petroleum in these Plans—in production, geology, exploration, drilling, transportation, refining, synthetic fuels, and chemicals.

Oil Policy: The oil industry has been subject to the dictates of the "law of planned and proportional development." Most of the effort has been concentrated upon developing the oil potential. Some 70% of the funds allocated to the oil industry during the last ten years has been used to finance prospecting and exploratory drilling.

China's sedimentary basin, nearly one million sq miles, covers 28% of the country's area. Of this, some 12% has been prospected so that by now 14 out of the 33 large oil-bearing zones are relatively well known. Proven reserves are 200 million tons which, at the current production rate, represent a 40-year supply. Possible reserves have risen from 262 million tons in 1949 to many billion tons at present.

A new oil policy adopted in March 1958, and aimed at speeding up production has three major principles: (1) simultaneous development, with national funds, of large oilfields and modern processing plants alongside more primitive communal developments; (2) erection of national and communal synthetic oil plants; and (3) nationwide search, at national and local levels, for new reserves of oil, shale and coal to feed the local plants. As a result, wide geographic distribution of liquid fuels has already been effected. Oil—up to now industrial China's weak link—is forging ahead.

Production: In 1959, crude production will be close to 4 million tons (80,000 b/d) or 75% over the 1958 level, and 2.7 times higher than in 1957.

The target set in 1956 for the last year of the second Five-Year Plan was 5 to 6 million tons. The 1962 goal has been raised now to 30 - 36 million tons (600,000 to 720,000 b/d). At this rate, the target of 40 million tons (800,000 b/d) initially set for 1967 may be fulfilled by 1963 or 1964.

The increase in 1959 production is accounted for by higher output in Karamai and Yumen oilfields, initial production in the Tsaidam basin, and new discoveries in the rich fields of Central Szechwan. However, nearly half of the total production still comes from old developments at Yumen in Kansu Province. Sinkiang-Uighur fields doubled production in 1959 as compared with the previous year.

Compared with proven reserves, present production is small. But for lack of tubular goods, transportation facilities and processing capacity—all requiring large quantities of steel—crude output easily could soar to tenfold the current rate. Many wells will remain closed in until current shortages are eased.

One means of raising crude output is to organize the masses for large-scale drilling and production by primitive manual methods. Yumen drillers have devised simple tools for small shallow fields in some 400 sq

miles scattered over Sinkiang, Tsinghai, Kweichow and northeast China. These shallow pools are looked to for a yield of several million tons annually by 1962 and, with the small synthetic oil plants, should cover rising needs of mechanized agriculture.

Drilling: Footage drilled in 1958 totaled 4,854,400 ft, twice the planned target, and equal to the aggregate drilling in the first Five-Year Plan. Footage drilled in 1957 was 1,577,000 ft. Increased drilling speeds are said to have lowered costs a third under 1957. During the second half of 1958, 96 drilling crews averaged 3,300 ft/rig/month, and the national record was held by a Yumen crew with 16,429 ft/rig/month. These records have been surpassed in 1959. Improved techniques included electric and radioactive logging, electrical coring, etc.

Present estimate is that some 300 rigs are operating throughout China's fields, of which 80 are heavy-duty outfits. Several Russian and Romanian-made turbodrills are also being used, mainly in Szechwan.

China's deepest well, 20,454 ft, was completed in November, 1958, in the Szechwan basin. Official figures on new wells and exploratory footage have not been revealed. However, it is estimated some 1,400 new wells were drilled in 1958, of which nearly half were exploratory—and of these, over 100 were drilled in the Szechwan basin alone.

Oilfield Equipment: China is now self-sufficient in oil drilling and production equipment. Industrial production of geophysical instruments such as airborne magnetometers, radiometers, and spectroscopes as well as complete drilling rigs began in 1958. Under construction now is a rig capable of drilling to 10,500 ft. A simple portable rig, developed by the Peking Petroleum Institute for drilling shallow formations by local crews, can drill 2,100-ft to 2,800-ft holes. Use of bamboo saves one ton of steel in the derrick, and the rig can be dismantled and reassembled in three hours.

However, increased production is being held back by lack of tubular goods. Seamless tube production is still confined to the Anshun works, which in 1958 by accelerated effort attained an output of 150,000 tons, or twice its designed capacity. Toward the end of 1958, a new seamless-tube plant was asembled at Shanghai No. 1 Iron and Steel Works with equipment designed and fabricated entirely in China. Its output is, however, reserved mostly for shipyards, chemical and boiler works.

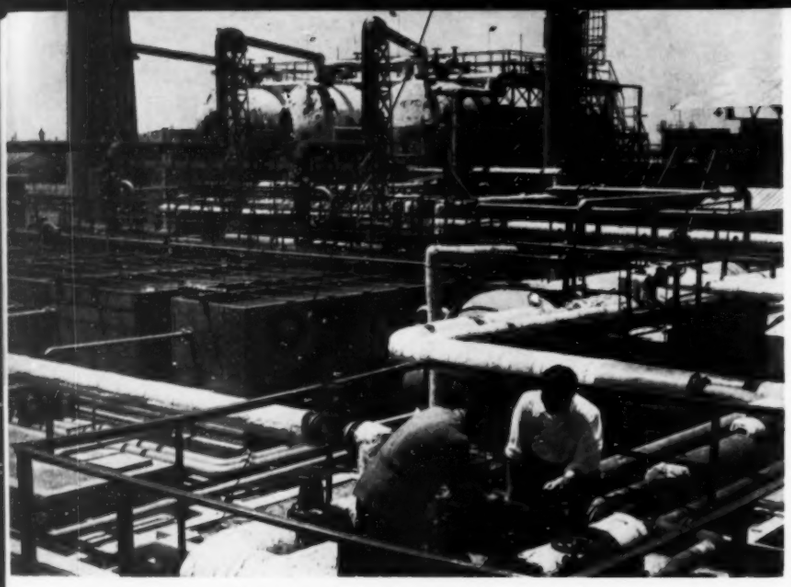
With Government assistance, local authorities in 1958 built small tube mills with total yearly capacity of 100,000 tons to manufacture 100-mm and 200-mm (4 and 8 in.) diameter pipe, plus 10 medium-sized mills, each with annual capacity of 7,000 tons for 8-mm to 100-mm pipe. Their aggregate output is, however, too small to aid an early upsurge in drilled footage. At least half of the tubular material used in China, and practically all tubulars used in Karamai, Tarim and Tsaidam basins, come from the steel mills of the Soviet Orbit.

Exploration: Between 1952 and 1957 (first Five-Year Plan) oil and gas exploration proceeded over an area of 112,000 square miles. Exploratory drilling totalling 2,755,000 ft accounted for half of the total footage drilled. Fifty-one new formations were explored, of which 21 are estimated "commercial."

With improved drilling techniques and better trained crews, exploratory drilling in 1958 equaled almost half the total footage drilled during the first Five-Year Plan. The result was 20 new commercial oil fields, and two new gas fields discovered. In all, 41 new formations have been prepared for development. These discoveries resulted from complete exploration of only 3% of China's total area of 3.7 million square miles. With 28% of this sedimentary basin, prospects for further finds are good.* By the end of 1958, nearly 500 possible or probable oil-bearing formations in a 400,000 square mile

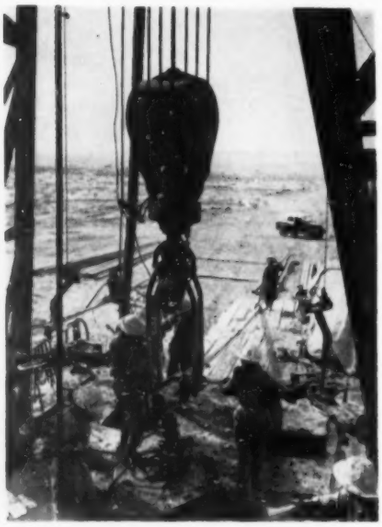
* A map of China's oil regions was published WORLD PETROLEUM, August, 1956, p 49; and a map of northwest China in February, 1958, p 48.

Rig goes in for a new test well in the Yumen field, Kansu Province, in northwestern China.



New coking unit which has been added to an oil refinery in Shanghai which produces full range of products.

Geologists collect crude oil that gushed from test wells in central Szechuan Province, southwestern China.



High speed drilling in the Karamai field, where a monthly record of 4,000 meters was established.

area had been identified. Of these, at least 100 are located in Kweichow, Kwangsi and Yumen Provinces, south of the Yangtse River. Stratigraphically, they are similar to those recently discovered in Szechwan.

During the past three years, aerial-magnetic and other geophysical prospecting methods have uncovered stratigraphic oil accumulations scattered widely over the vast stretches of the Sungary Liao Plain in northeast China. Two important new formations were discovered in 1958 near the shores of the Sungary River—indicative of other oil-bearing formations in the Sungary valley.

Oil indications abound in the Lower Yangtse River area and on the North Kiangsu Plain. Early in 1958, seepages were found near Funning in Kiangsu Province where exploration now is going on. Other oil and gas seepages—some of them known for centuries—have also been discovered in 20 provinces and autonomous regions. Of greater significance are those in Szechwan, Cheking, Fukien and Kwantung. The formations in Northern Kiangsu, around Shanghai, and in the Kirin district, are now being explored.

The biggest discovery in China's oil history occurred in March 1958 in Szechwan Province, Central China, which long has been known as oil-bearing. Szechwan is already regarded as China's third largest field after Karamai and Yumen. Intensive prospecting which started three years earlier with Russian assistance resulted in locating 22 oil-bearing formations. Three successful tests proved an 850-square mile triangular oil area. The first test well—in a 400-square mile radius, half of which was thoroughly prospected prior to drilling—was on the Lungnuszu formation between Wusheng and Yushchih counties. The second well—in a 300-square mile radius around Nanchung—has been producing 200 ton/day since completion. The third test—farther west on the Penglai formation—is flowing 180 ton/day. Average depth of the three wells is 4,900 ft.

Following these discoveries, the program was expanded to drill 14 times more footage than originally planned. Despite lack of equipment and local facilities, 117 wells were completed in 1958, most of them by 40 teams from Yumen. At present, several thousand drillers are active in the Szechwan region.

In May 1958, on the Kuangan formation of Central Szechwan, seven wells averaging 3,300 ft in depth were successful, some encountering three to seven pay sands with good natural pressure. Kuangan is believed better than the three earlier Szechwan discoveries. In August 1958, the first test on the Hochwan formation in Central Szechwan, between the Chialing and Chu Rivers, discovered oil at 3,700 ft. At about the same time, two wells on the Hsiang-Kuoszu formation, near Chunking, 60 miles from the Central Szechwan fields, found abundant oil. Subsequent search in the Eastern Szechwan basin discovered several formations with good prospects in the fall of 1958.

Lack of transportation and processing facilities held Szechwan crude production to 100,000 tons (2,000 b/d) in 1958, but substantial increase is looked for soon. Trucks carry the oil while railroads and highways are being built, and the treacherous Chialing River is being cleared to carry 50-ton barges between Nanchung and Hochwan.

With exploration continuing intensively in Szechwan, three gas fields had been discovered by the end of 1958. The largest, Huangkuashan, with a yield of 70 million cf/d is believed to have serveral hundred billion cubic feet of reserves. In southern Szechwan, six other fields form a large gas pool in an area of some 800 square miles.

Close to, and south of Szechwan, 80 test wells drilled in the 66,000-square mile Kweichow field encountered oil in July 1958. Drilling at Kweichow in the latter half of 1958 totaled 350,000 ft. With over 200 oil outcrops and gas seepages, it is regarded as "very promising." Forty crews are working to determine the field's limits and the extent of the 80 finds.

Other discoveries made in 1958 included one near Harbin (Heilungkiang) with probable reserves of two billion tons, and two oil-bearing formations in the neighboring Kirin district. Other new finds were at Tsaidam, Tsinghai Province, first explored in 1954.

In September 1958, at Tsaidam, three wells on the Lenghu No. 5 formation, located at the terminus of the projected Lanchow-Tsinghai railroad, yielded several tons per hour from 1,981 ft, and several tests on Lenghu No. 4 encountered light oil (40% gasoline and 35% kerosine). There are 10,000 workers now busy drilling and producing at Lenghu.

Yushashan (in the Kunlun Mountain

hills near Mangya), another promising area at Tsaidam, is a low-pressure pool with considerable reserves. In July, 1958, a well which tested 7.5 ton/day yielded light oil from 3,509 ft. Four tests at Yuha, in the same area, are producing from a layer between 656 and 840 ft. A number of wells are planned to tap Yuka's shallow formations. Eight other fields in the same area, discovered several years ago, proved commercial in 1958. A test drilling at Shihtzukow, within the Yushashan district, encountered oil between 2,952 and 3,510 ft in July 1958; its proven reserves are estimated already at 30 million tons.

During 1958, rich gas fields were discovered at Tsaidam. Two fields in the Mahai district—Yenhu and Hsiaotsaidan—produce some 10 million cf/d per well from two layers. Other rich gas strikes were in Yuchuantse district, and at Chientingshan, Tülinku and Kanchaiku.

Karamai oil field, in the Sinkiang-Uighur Autonomous Region, is proving much larger than originally estimated. Exploration drilling in 1958 extended its limits, and increased proven reserves by 40%. Probable reserves are now estimated at 500 million tons, much greater than Yumen's. Several tests extended Karamai's southern limits, and good quantities of oil found 40 to 60 miles east of the field proper are believed to extend Karamai's eastern limits.

Sixty miles from Karamai, a new field was found during 1958 in the Uerho area. Oil out-crops at Uerho proper extend over a 12-square mile area. Drilling in 1958 proved Karamai and Uerho to be one large field. Oil was found also at Ormou, 70 miles northeast of Karamai, with a good-quality asphalt. If further drilling would prove that Ormou is also linked with Karamai, the entire northwest section of the Dzhungaria basin will constitute one large oil field.

Efficient large scale development of Karamai field is being carried out, and workers pledged themselves in June 1958 to exceed the 1962 target of 3 million tons (60,000 b/d). Field gathering lines totaling over 100 miles were completed in 1959. An even larger plan, blueprinted in the spring of 1958, is to assess the limits and potential of six new prospecting areas in the Dzhungaria and Turfan basins of Sinkiang. The Sinkiang Petroleum Control Board has organized 100 geological and geophysical crews, of which about 20 are already at work in the areas bordering the Tarim basin and the Takla Makan desert.

In the Dzhungaria basin, oil was encountered at 2,600 ft in July 1958 at Chiku, some 60 miles from Urumchi. The initial test flowed 60 ton/day. In April and May of the same year, two topographic and geological crews entered the vast arid Takla Makan desert but results of their investigations are not yet known. The stratigraphy of the 155,000-square mile desert (625 miles east to west, 250 miles north to south) indicates a marine sedimentary basin with oil possibilities.

In the Tarim basin, the first well on the Ichirkirk formation tested 100 ton/day in October 1958, and deeper drilling is in progress. Because of its growing importance, Tarim has had its own oil administration headquartered at Aksu since August 1958.

First survey of the Turfan field in May 1958 classified it as "promising": 29 possible and probable oil formations have been located, of which six were drilled in 1958. The "Flame Hills" area in the Houyenshan Mountains, Shengchinkow, 75 miles long, had a test well on November 7, 1958.

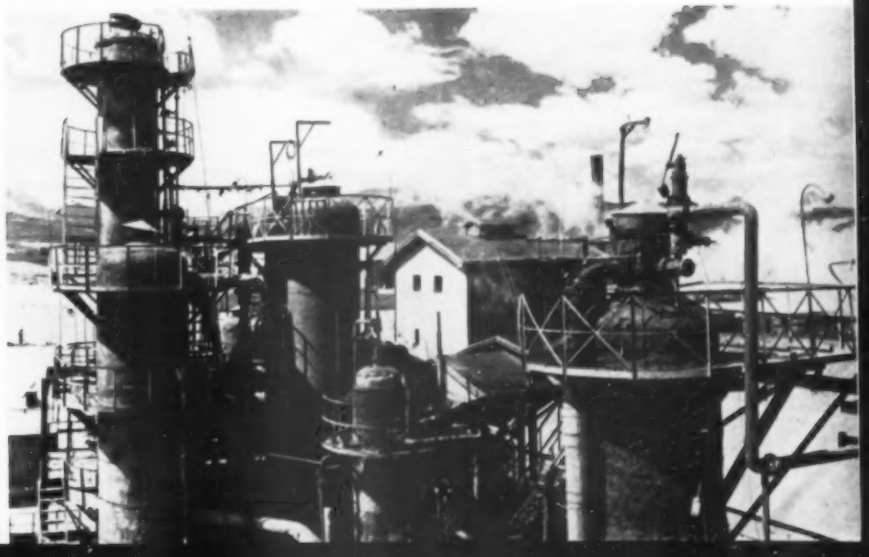
The oldest field, Yumen in Kiuchuan, is still China's main producer and largest development. Two test wells drilled on the Yaerhchia formation—discovered in 1956—had initial yields of 100 and 250 tons/day; and by the end of 1958, several wells were producing in the area. Roads, gathering lines and a pipeline to Lanchow have been completed. Several thousand drillers are at work in this area. Preliminary estimates place Yaerhchia's reserves at more than double those of Laochunimiao, Yumen's major producer. With the rich Yaerhchia discoveries, and another at Paiyangho in the Kansu Corridor (now being drilled), officials believe Kiushuan's output by 1962 should double the 1957 level. This should be feasible when transportation and water bottlenecks are eliminated with construction of a 10-mile long tunnel to bring water from the Paiyan River to Yumen oil fields, and a 700-mile long, 130-ft wide Tao River canal to cross Kansu. De-salting plants were completed at Yaerhchia and Paiyangho in 1959.

Geological Survey: A Five-Year Plan for geological survey was instituted on June 3, 1958 to coordinate China's rapid industrialization with her second Five-Year Plan. It envisions a "people's army" searching for new mineral deposits throughout China. Emphasis is laid upon finding by 1962 new iron-ore deposits of at least 9.4 billion tons.

Young geologists prospecting in the Karamai oil field. China has been training geologists since 1949.

Vacuum still at the Lanchou refinery which was built to Soviet designs.

An oil refinery in Yumen, Kansu Province.



60 billions of new coal, and a wide search for other minerals.

This Plan was tied with a decentralization decision through which the authority for prospecting has been transferred to local authorities. Prospecting planning and its fulfillment is supervised now by the provincial Party Committees. The Ministry of Geology drafts the national plan and provides technical assistance to provinces and autonomous regions. All the 26 Provinces and Autonomous Regions have geological bureaus; many communes already have geological sections. In 1959, 20,000 geophysical workers were active all over China, applying magnetic, electric, seismic and radiogeological methods.

For petroleum, the Survey Plan provides for continued exploratory drilling, mainly in Szechwan, Sinkiang, Tsaidam and on other promising formations already identified in northern and northeastern China, in Kiangsu, Kweichow and southeastern China as well as completion of a survey of oil-shale deposits to increase proven reserves by at least four billion tons.

In 1959, the greatest effort was concentrated on the vast Sungliao Plain in eastern China, on which a number of oil-bearing formations have been located earlier through aerial-magnetic and geophysical survey carried out during 1956-1958 with the aid of Russian and Hungarian experts.

An oil conference in Yumen in 1958 revised oil production targets upwards for the second Five-Year Plan. Figures were not announced but the conference issued directives for mass organization for large-scale drilling and exploitation of small shallow fields by traditional primitive methods.

During the last 10 years, the number of geologists rose from 300 to 40,000, and more are being trained at the Petroleum Institutes at Peking, Sian and Chengtu. The latter two were established in September 1958. The 270,000 technically trained geological workers of secondary-school level are insufficient for increased prospecting, and chemical analysts are in critical short supply. Further cadres are being trained in 25 geological special schools and evening courses.

In September 1958, 20,000 geological and chemical students and faculty members were organized in teams to make a 3 to 4-month survey in various parts of China. Another 14,000 teachers and students of geological schools and institutes assist a "people's army" of 20 million throughout China to comb the mountains for new minerals.

Transportation: During 1958 and 1959, little progress was made in transportation, which remains the weakest link in China's oil industry.

A 548-mile pipeline from the Yumen oilfield to the Lanchow refinery has not yet been completed. A 92-mile, 500,000 ton/year (10,000 b/d) line had been completed by the end of 1958 from Karamai oilfield to the Tushantze refinery and a second line paralleling the first was completed in 1959. Crude-carrying cost is 4 yuan/ton. Cost by lorry is 44 yuan, with losses increasing the latter. Another 34-mile, small-diameter, line runs from Karamai to Kul. A new pipeline is to be laid from the newly discovered Central Szechwan fields to an undisclosed destination.

Refining: In 1959, 33% more gasoline and 67% more diesel oil were produced than in 1958.

Most important new facility was the completion of the one-million ton/year (20,000 b/d) Lanchow refinery, begun in 1955. With major process units supplied by the USSR and Romania, it has been operating on trial since September, 1958.

The older, 8,000 b/d Yumen refinery is reported to have stepped up its output of 12 oil products in 1958, including heavy diesel, No. 30 lube oil, and pitch. A new, medium-size refinery went onstream last March at Yumen.

Fourfold expansion during 1958 and 1959 at the Shanghai refinery makes its capacity equal to Lanchow's. It is also being provided with petrochemical facilities. Its rapid expansion was to meet growing oil production in Central Szechwan from whence crude oil has been pooled, since June 1958, in the vicinity of Chiunking for shipment 1,600 miles down the Yangtse to Shanghai.

Also to meet immediate needs of the growing Central Szechwan fields, construction began in July 1958 on a 300,000 ton/year (6,000 b/d) refinery at Nanchung. Nine smaller plants with aggregate capacity of 100,000 ton/year have been operating in the area since May, 1958. Three of them, each of 10,000 ton/year capacity (200 b/d) located at Nanchung and Lungnuszu, suffice to cover drilling and transportation needs on the spot. Nearby, in the Suining area, a 90,000 ton/year (1,800 b/d) refinery is to go onstream soon. Several 4,000 to 10,000-ton storage tanks have been completed near Nanchung, Lungnuszu and Panglai.

The Tushantze refinery in Sinkiang was expanded further during 1958 and 1959 to provide for rising production at Karamai. Also operating in Karamai oilfields is a medium-sized plant, the "August 3rd Refinery." A 250,000 ton/year (5,000 b/d) plant is under construction at Yushashan, near Mangya, in the Tsaidam oil area. Several 5,000 to 10,000-ton storage tanks were completed here in 1959. At present, there are five refineries operating in the Tsaidam basin, of which the biggest, 100,000 ton/year (2,000 b/d) at Yuchuantzu, went onstream in March 1959, and another at Lenghu, of a similar capacity, has just been completed.

Additional capacity of 2,600,000 tons (52,000 b/d) has been completed during 1959—an unprecedented feat for China—raising capacity to over 4,000,000 ton/year (80,000 b/d), a little higher than the crude production level. During 1959, construction was started on other large refineries to keep pace with rising crude output.

A new oil refinery is planned at Shihhotzu, in the Gobi desert, on the Manas River. Its ultimate capacity will be of 3,000,000 ton/year (60,000 b/d). At Shihhotzu there will also be a petrochemical plant, a drill factory, a general machine works and a thermoelectric power station of 300,000 KW generating capacity.

As in all the other sectors of the planned economy, refining growth will proceed on two fronts: (1) large national, and (2) small decentralized projects. During 1958, some 500 medium and small refineries with total capacity of 1,200,000 ton/year (24,000 b/d) were built throughout China. Fifteen standard designs for plants ranging from 300 to 500 ton/year have been prepared by the Ministry of Petroleum and distributed to local authorities. With plants erected locally with whatever is at hand, technical assistance and equipment from the ministry may be provided.

Many other plants, of capacities ranging from 15 to 300, and from 300 to 3,000 ton/year are being built in the oil producing regions—some eventually to attain 10,000 to 100,000-ton/year capacity. Most of them today are makeshifts, inefficient and wasteful; for example, the pilot refinery built by Tushantze engineers which costs 8,000 yuan to build but extracts not more than 1.7 ton of gasoline and 1.9 ton of diesel oil out of every 10 ton of crude. The local plants are built and operated by the people's communes for covering the increasing needs of farm machinery and transportation.

Synthetic Liquid Fuels: China's official statistics do not reveal the very considerable effort made during 1958 and 1959 to produce synthetic liquid fuels, under a pattern similar to that for crude refining. Local ingenuity and inventiveness, however, are not too successful in operating inefficient stills which interchangeably burn oil shale, bituminous coal, lignite, peat or turpentine. Insignificant quantities of gasoline, kerosine, diesel oil and other products result, and with a high percentage of impurities. Even cotton-seed meal, pine root, pine resins and

Crude oil from Yumen field being loaded into tank car train. This field has been linked by railway since 1956 to other parts of China.

birch bark were being used as raw materials.

During 1958, 1,400 small synthetic oil plants were built throughout China's 27 provinces, most of them by the people's communes. Applying low-temperature coal carbonization, their aggregate capacity is about 500,000 ton/year (10,000 b/d)—exceeding by half the new capacity of the synthetic oil refining plants built between 1950 and 1957.

Following the addition of scores of plants of 10,000 ton/year capacity and higher, erected mainly in Yunnan, Ninghsia, Hopei, Kwangsi and Shensi Provinces, their total number rose to over 10,000 with aggregate capacity of 1,800,000 ton/year (36,000 b/d). Some provinces have been selected to become synthetic oil centers. Shensi, for instance, should by 1962 produce as much oil by dry distillation as the whole of China during the first Five-Year Plan.

To power these plants, rural electrification is to be stepped up, with a goal for 1968 of 15 to 18 million KW generating capacity. During 1958, 11,000 small hydroelectric stations, totaling 205,200 KW, were built, and more than 100,000 coal pits were opened to supply rural electrification, steel smelters, and synthetic oil installations.

Large synthetic oil plants, using shale and coal, are also under construction. A shale-oil refinery is being built at Mowming, Kwantung Province. It will have 2 million ton/year (40,000 b/d) ultimate capacity by 1962, with 20,000 b/d scheduled to begin operating in 1960. In addition to gasoline and diesel oil, the plant will manufacture a complete line of oil and chemical products. The first stills have been operating experimentally since July 1958. Another shale-oil plant, of similar capacity, is being erected at Fushun, Liaoning Province, where already several shale-oil plants have been operating for many years.

A sizeable synthetic oil plant is under construction near the rich gas fields discovered recently at Huangkuashan, Szechwan Province. It will use natural gas as raw material. Slated for completion in 1962, another synthetic plant, of similar capacity, has been started near the large Tatung coal fields. It will process high oil-content bituminous coal, of which large reserves have been found in northern Shensi.

Production of shale oil in 1958 was nearly 16,000,000 tons (320,000 b/d), and that of oil from coal and other raw materials was at least 2,000,000 tons (40,000 b/d). In 1959, supplies from these sources amounted to more than five times crude oil production. A planned network of synthetic oil plants will materially alter China's fuel-supply picture. This applies particularly to Manchuria, to the eastern and southeastern provinces and to Central China where sizeable oil deposits are unlikely to be found.

Chinese engineers can now design shale and oil-from-coal refineries of 2,000,000 ton/year (40,000 b/d) capacity, and machine builders have obtained the know-how for manufacturing the required high-pressure reactors and other equipment.

China's probable oil-shale reserves rose to almost 360 billion tons following the great discoveries of 1958 and 1959, while proven reserves already exceed 60 billion tons. These insure a shale-oil supply of 50 to 80 million tons/year (1,000,000 to 1,600,000 b/d) for the next 50 years. In all, there are 180 commercial shale deposits spread over 21 provinces and autonomous regions—half of them susceptible of open-pit mining. The largest known deposit is at Fushun in Manchuria with a 6 to 10% oil content. A new deposit of almost similar proportions was tapped in 1958 in the Mutanchiang area, extending over 800 square miles in Heilungkiang Province. With proven reserves of 180 million tons at the end of 1958, its ultimate reserves are estimated at 120 billion tons. Shale deposits in the 200-million-ton reserve category have been discovered in the mountains around Urumchi and in the Kansu Corridor; their oil content varies between 6 and 20%. Other substantial deposits have been tapped in Hunan, Hopei, Inner Mongolia, Kirin, Yunnan, Kweichow and Honan.

In addition to existing coal deposits of varying extent and quality, large quantities of brown coal were discovered in 1958 with an oil content ranging from 6 to 10% in Shensi, Kwangsi, Heilungkiang and Inner Mongolia. South of the Yangtse River, more than 20 fields of bituminous, brown and coking coal have been located in Szechwan, Anhwei, Chekiang, Fukien and Kwantung—with Kweichow and Kwantung having already proven reserves in excess of 2 billion tons. Following these discoveries, China's possible coal reserves rose from 1.5 to almost 9 trillion tons. Coal production reached 270 million tons (130 million in 1957). The 1959 target is 335 million tons. Small local pits mined some 45 million tons last year, and by 1962, should fulfill a target of 160 million tons.

Chemical Industry: Chemical industry output rose 25 fold between 1949 and 1958, due solely to a great increase in chemical fertilizer production. With 1,000 new fertilizer plants slated for completion in 1958-1962, fertilizer output is to rise from 1.3 million to 15-20 million tons. Estimated plastics output in 1958 was 3,000 tons, and 240,000 truck tires were produced.

Chemical production targets for 1962 (in tons) are: 100,000 synthetic fibres; 20,000 plastics; 4,500,000 sulfuric acid; 860,000 caustic soda; 170,000 pure soda; 135,000 insecticides 1,200 antibiotics. Production of methyl ethyl ketone, carbinol, acetone, etc., is also to be doubled. These objectives are to be attained under the same pattern as in petroleum—large State plants as well as medium and small ones run by the people's communes.

China's oldest and primary chemical center is Shanghai, where all of the plastics and most of the synthetic fibres and rubber were produced in 1958. New chemical centers are rising rapidly in Kirin, Harbin and Tientsin. At Kirin, northeastern China's first modern chemical center, several works are under construction which will turn out by 1962 one million tons of some 300 different chemical products (only 24 in 1958), including synthetic fibres, oil and rubber, plastics, synthetic ammonia for aminoplast, high-grade dyestuffs, etc.

Tientsin has under construction 58 new or expanding plants, among them the Yungli-Chiute chemical works and the No. 3 Rubber Plant. China's largest pharmaceutical center also is in Tientsin.

At Harbin, China's fourth chemical center, 31 plants have been completed during the past years, including a 6,000 ton/year synthetic fibre plant, an 8,000 ton/year rubber plant, and a 2,000 ton/year plastics plant.

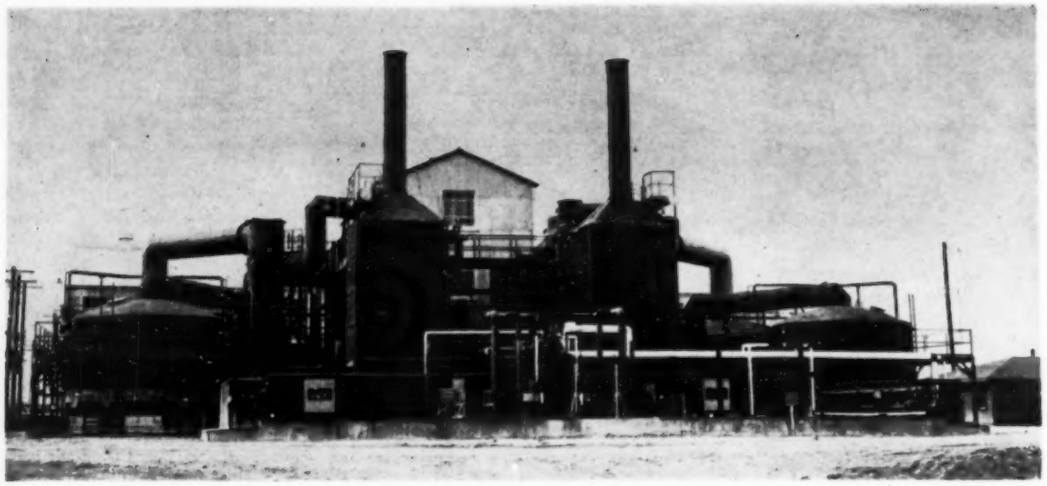
The variety of chemicals produced increased greatly in 1958: the number of different pharmaceuticals, paints, dyestuffs and chemical reagents expended two to eight times between 1957 and 1958. Several plants producing polyvinyl chloride, neoprene, aminoplast, and organic glass will soon start operation in Peking, Shanghai, Tientsin, Kiangsu, and Kweichow.

China's synthetic rubber products now include tires for passenger cars, trucks, tractors and aircraft; cordless tires; tires for 25-ton trucks; parts and accessories for industrial equipment. New items produced on an experimental basis include fluorine plastics, organic silicon, paints, polyethylene plastics, epoxy and ion-exchange resins.

During 1958, construction of 50 large and medium-sized chemical plants was started or planned, among them several enterprises for synthetic fibres and rubber. China's machine industry can now manufacture much of the equipment such as high-pressure vessels, gas compressors, carbon dioxide scrubbers, furnaces, and so on.

Basic research has resulted in new and improved processes for chemical synthesis, among which is synthetic oil processing through fluidization under medium pressure. Water-gas synthesis is now regarded as a shorter and cheaper route to increasing the capacity of synthetic oil refineries and chemical plants as it requires smaller investments and a simpler technology. A shale-oil refinery in Chinchow is already applying the new synthesis.

A solid foundation for the synthetic chemical industry will be laid during the current Five-Year Plan. Some 77 standards for plants, ranging from a 500-ton polyvinyl-chloride to a 20,000-ton calcium carbide plant, are being worked out. Emphasis is laid on large-scale production of such items as synthetic fibre, caprone, neoprene, aminoplast, polyvinyl chloride plastics. Progress has also been made in pilot production of orlon and various nylons. Plants have been completed in Peking, Shanghai, and Tientsin, and others are under construction in Chekiang, Szechwan and Kwantung. Scores of new plants are being built throughout the provinces near large coal deposits. END



A British sulfur recovery plant at Fawley (Photo courtesy of Foster Wheeler Corp.)

Today's petrochemical methods for sulfur recovery

by Peter W. Sherwood*

Sour hydrocarbon gases are an attractive economic source in most locations. Conversion of hydrogen sulfide to elemental sulfur — a major step in the process — is described.

HYDROGEN SULFIDE, recovered from sour hydrocarbon gases, is the fastest growing source of sulfur today. The first modern sulfur recovery plant operated in the USA was taken on-stream in 1944 by Southern Acid and Sulphur Co. at McKamie, Ark. (now owned by Olin Mathieson). Following a period of incubation, recovery of elemental sulfur from sour gas rose precipitously, beginning in 1950. By 1958, this source accounted for 619,600 long tons sulfur production. Total USA sulfur production during that year was 4.4 million long tons.

Today, there are 58 USA companies engaged in the recovery of sulfur from sour gases with plants ranging in size upward of 10 t/d. Probably the world's largest single sulfur recovery unit is British American Oil Company's Pincher Creek plant near Calgary, Alta. with a rated daily capacity of 750 long tons sulfur.

Several factors have been responsible for the rapid expansion in sulfur recovery from sour gases. On the purely economic side, the principal incentive came from the rise in the price of sulfur which rose from $16-$18 during the early 1940's to a high of $31 per long ton in the first part of 1956. (Prices for sulfur are normally quoted f.o.b. Gulf Coast.)

Since then, the price of sulfur has again declined ($25 per long ton in June 1959), as new sources of supply become available. Principal new source is Mexican Frasch sulfur which rose from 100,000 long tons in 1954 to somewhat more than 1.2 million tons in 1958. At the same time, important new sulfur production has been established in Canada (principally by recovery from sour gas) and in France. Thus, the USA's share of total (non-Communist) world production has declined from 85.6% in 1954 to 66.6% in 1958.

Even at the present price level, sulfur recovery from sour gas is, in most locations, an economically attractive proposition. Three major operations are involved: (1) removal of hydrogen sulfide from the gas; (2) dehydration of the residual gas, and (3) conversion of hydrogen sulfide to elemental sulfur. Of these three steps, the first two must be carried out in any event in order to satisfy the requirements of the gas transmission system and the demands of the gas market.

The third step—conversion of hydrogen sulfide to elemental sulfur—is the scope of our present discussion. This operation is in effect an upgrading process, a means to convert a nuisance by-product to a salable commodity. Activity in this field is thus controlled by two main factors: the more extensive need to use sour gas and crudes, and the oil and gas industry's increasing concern with air pollution.

Of the two factors, the increasing trend toward utilization of sour hydrocarbon stocks determines the amount of sulfur which is potentially available from recovery plants. In this field, sulfur is strictly a by-product: the amount of sour stocks processed is determined by other considerations; the volume of hydrogen sulfide recovered depends solely on the volume of hydrocarbon handled and on the sulfur content of the crude or natural gas which serves as feedstock.

* Chemical Engineer, White Plains, N.Y.

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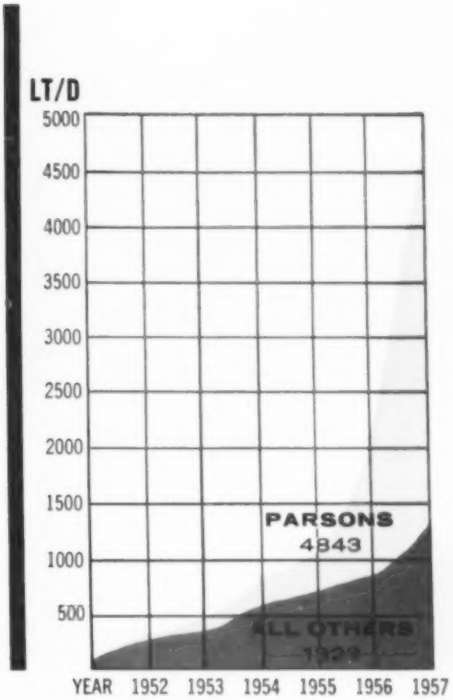

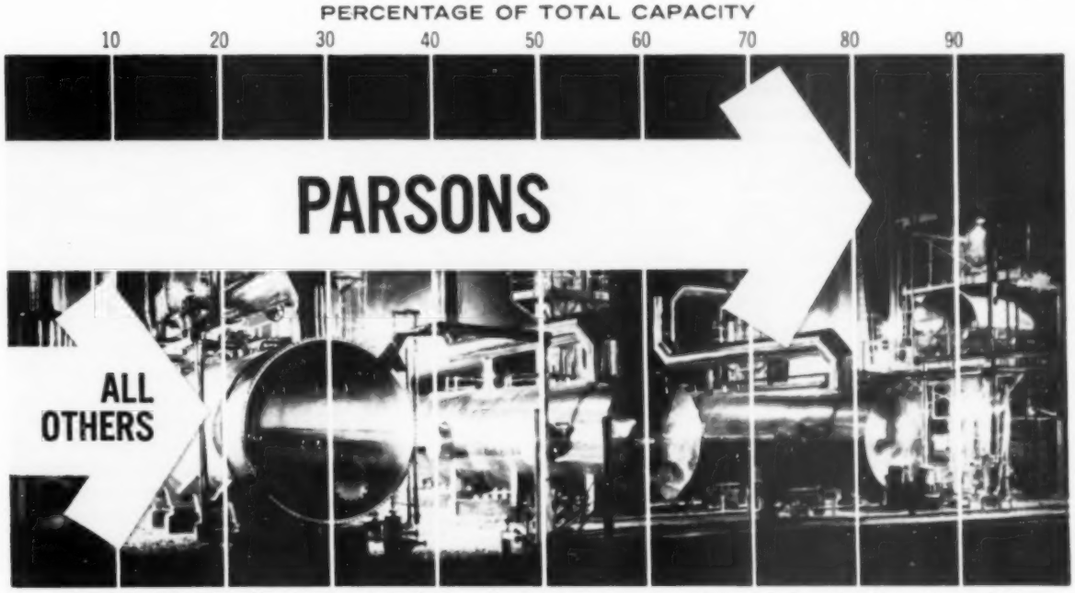

LACQ, FRANCE: First of six units by Parsons-Heurtey is now on stream in world's largest sulfur recovery plant.

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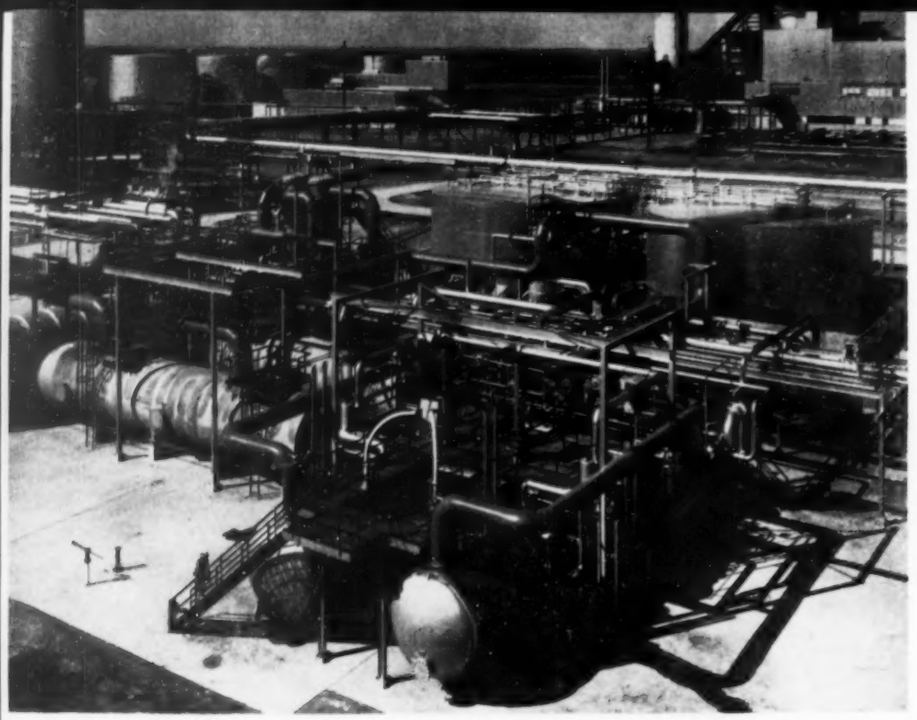

A modern plant for recovery of elemental sulfur from hydrogen sulfide. Tidewater Oil Co.'s 375 t/d unit at Delaware City. (Photo courtesy of C. F. Braun & Co.)

Recovered hydrogen sulfide may be disposed of in three ways. It may be directly converted to sulfuric acid; it may be flared, or it may be converted to elemental sulfur.

Direct oxidation of H_2S to sulfuric acid has long been practiced but it is definitely on the decline. In 1958, this approach accounted for less than 1% of total sulfur processed in the United States. By comparison, the conversion of H_2S to elemental sulfur was responsible for 8% of equivalent sulfur production.

There are several reasons why the conversion of H_2S to sulfur is favored over the direct production of sulfuric acid. First of all, production of sulfuric acid calls for large installations in order to be economic—exceeding in size the sulfur available at most recovery sites. Beyond that, burning H_2S yields water as well as SO_2, and thus results in a dilute grade of sulfuric acid. H_2SO_4 production from H_2S is normally carried out only in conjunction with sulfur oxidation in very large installations.

Conversion of H_2S to elemental sulfur is favored over direct oxidation to sulfuric acid for other reasons as well. Of primary influence is the availability of a wider market for sulfur, and especially for recovered sulfur which is a purer grade than mined or Frasch sulfur. Beyond that, investment cost in a recovery unit is less than one-third of that for a sulfuric acid plant of equal sulfur capacity. There are also fewer problems in sulfur recovery, the efficiency in small units is about as good as in large installations, and performance is relatively stable in the face of wide fluctuations in throughput.

Still another advantage is that sulfur is stocked quite simply by pouring it into blocks. Finally, there are freight benefits in shipping sulfur rather than sulfuric acid. This is especially important if the acid consuming area is at some distance from the H_2S recovery unit.

Much of the rapid increase in markets for recovered sulfur has come at the expense of sulfur oxide gases obtained as by-products in the roasting of pyrites and other sulfidic metal ores. These off-gases are converted to sulfuric acid. Potentially, at least, this may also be reacted with hydrogen sulfide which may be available in the smelter's vicinity, to yield elemental sulfur.

Frasch mining continues, of course, to be the principal source of sulfur. In 1958, the sources of sulfur (and equivalent sulfur oxides) produced in the USA were distributed as followed:[1]

Elemental Sulfur—	
Frasch	63%
Recovered from H_2S	8%
Sulfur Dioxide—	
Pyrites	9%
Smelter gases	6%
H_2S	1%
Acid sludge	4%
Sulfuric Acid—	
Recycled Acid	9%

Sulfur enters its consuming industries in three main forms: as elemental sulfur, as sulfuric acid, and as sulfurous acid. The end use distribution pattern for these three commodities is reported as follows:[1]

Sulfur (10%)—	
Rubber	1%
Other chemicals	2%
Insecticides, fungicides	2%
Carbon disulfide	4%
Miscellaneous	1%
Sulfurous Acid (7%)	
Sulfite pulp	7%
Sulfuric Acid (82%)—	
Fertilizer	29%
Chemicals	21%
Petroleum	9%
Paints and Pigments	7%
Steel	5%
Rayon	4%
Miscellaneous	7%

It is noteworthy that the petroleum industry, a net consumer of sulfur (as sulfuric acid) until a few years ago, is today a net producer of this commodity, due to more extensive recovery of spent acid but, more importantly, due to the rapid expansion which has taken place in the recovery of elemental sulfur.

In general, the sulfur produced by small recovery plants is contracted for before the unit is built. Most of the output of large recovery facilities, on the other hand, competes with sulfur obtained from other sources of supply.

Technology of Sulfur Recovery. Today's commercial sulfur recovery processes are based on the work of Claus and Chance in England at the turn of the century. The original work of Claus involved the partial combustion of H_2S by means of air, using a bed of bauxite as catalyst:

$$H_2S + \tfrac{1}{2} O_2 \rightarrow H_2O + S \quad \ldots\ldots (1)$$

This reaction is accompanied by the evolution of 53 kcal/g-mole. In the original Claus oven, this entire heat was abstracted by radiation and the process became economically unworkable because permissible space velocity was only about 3 vols H_2S/vol catalyst/hour so that a daily production of one ton sulfur called for 250-300 cu ft of reactor space.

The key for removing this limitation has been the separation of reaction (1) into two stages:

$$1/3\ H_2S + 1/2\ O_2 \rightarrow 1/3\ H_2O + 1/3\ SO_2 + 41.3\ \text{Kcal} \quad \ldots\ldots (2)$$

$$2/3\ H_2S + 1/3\ SO_2 \rightarrow S + 2/3\ H_2O + 11.7\ \text{Kcal} \quad \ldots (3)$$

Reaction (2) is carried out thermally at high temperature. Heat removal presents no problem. High space velocities are possible. Reaction (3), on the other hand, is carried out catalytically at about 280C. It evolves only one-fifth the heat due to reaction (1) and effects a corresponding saving in reactor volume and heat removal requirements.

The two-step approach is incorporated into the two basic flow schemes by which sulfur is recovered today. In the dominant version, the entire H_2S stream is joined by the stoichiometric equivalent of air. The mixture is passed into a waste-heat boiler where reaction (2) and about 70% of reaction (3) take place. The burden on the catalytic converters, which follow the boiler, is thereby greatly lightened.

In an alternative flow scheme which is useful particularly for conversion of dilute

H_2S, the SO_2 is generated by combustion of product sulfur in a separate chamber (usually a waste heat boiler). Sulfur dioxide so generated is reacted with the feedstream H_2S in catalytic converters.

A problem is created by the formation of carbonyl sulfide (COS) due to reaction of sulfur with carbon dioxide in the high-temperature combustion stage. This side reaction is objectionable because it creates an air contamination problem and because it depresses sulfur yield. Reversion of carbonyl sulfide to elemental sulfur is possible at the operating conditions of the catalytic H_2S converters. However, the needed reaction of COS with SO_2 is substantially slower than the simultaneously occurring main reaction of H_2S with SO_2.

Where a serious problem due to carbonyl sulfide formation is encountered, a practical solution exists in the use of two catalytic converters in series. The first stage is operated at about 400C to permit completeness of carbonyl sulfide conversion at tolerable space velocities. The second reactor is run at 260-300C to finish up the hydrogen sulfide conversion which is more rapid but which has an unfavorable equilibrium at high temperature.

The presence of hydrocarbons in the feedstream to the catalytic converters is objectionable because of resulting carbon deposition and fouling of the catalyst bed. Conditions in the thermal combustion stage must therefore be controlled to assure complete oxidation of the hydrocarbons contained in the feed gas. In the case of a feedstream which is rich in hydrocarbons, this requirement leads to high carbon dioxide concentration and, consequently, to a problem of carbonyl sulfide formation, to which we have referred above. In such instances, it is preferable to obtain a portion of the sulfur dioxide feed to the catalyst cases by the combustion of elemental sulfur.

The partial oxidation of hydrogen sulfide to sulfur is an equilibrium reaction or, more precisely, a series of equilibrium reactions in which different forms of product sulfur play a role. Best theoretical conversion is obtainable at low temperature (app. 99% at 130C). As the temperature is increased, theoretical sulfur formation passes through a minimum value of 53% between 530 and 630C. Above this temperature, conversion at equilibrium picks up again and reaches a maximum value in the 70-75% range.

These thermodynamic considerations have three important consequences in the design of sulfur conversion plants: (1) the high-temperature reaction, which is carried out thermally in a boiler, cannot achieve more than 70-75% conversion (to elemental sulfur); (2) process gas leaving the thermal conversion stage must be cooled quickly to prevent establishment of the unfavorable equilibrium in the 530-630C range; (3) the catalytic step, used to complete the reaction, should be carried out at the lowest temperature which is compatible with considerations of sulfur dew point and of practical space velocity.

The catalyst employed commercially in the sulfur recovery reaction is a natural or a synthetic activated bauxite. Because of cost considerations, natural bauxites are normally preferred. Good catalytic activity is shown by bauxites of high iron content ($> 20\%$ Fe_2O_3) but these materials have low mechanical strength. Current USA practice favors the use of low-iron activated bauxites such as Porocel. Customarily, this catalyst is used in the form of 4-8 mesh particles, mounted in fixed bed equipment. For low pressure drop, the catalyst bed is of large diameter and shallow.

The key process variables in operation of catalytic sulfur converters are pressure, temperature and space velocity.

The importance of pressure rests in its effect on the dew point of the system and on the reaction equilibrium. At a given temperature, increasing the pressure favors sulfur formation. However, the rise in dew point which occurs with increasing pressure makes it necessary to operate at higher temperature which is thermodynamically less desirable. In general it is found that best overall performance is obtained by operating near atmospheric pressure.

The effect of temperature has been discussed above. Thermodynamic considerations show that the thermal part of the conversion calls for high temperature and that the catalytic finishing stage should be completed at the lowest possible temperature; i.e. just above the dew point.

In the temperature range 200-300C the effect of contact time on the conversion of H_2S to sulfur is not very pronounced. Space velocities up to 400 cu ft/catalyst/hour may be employed. However, space velocity does become a controlling consideration in the conversion of carbonyl sulfide which is always present in the feed gas to the catalytic converters.

It is therefore generally advantageous to carry out the catalytic part of the conversion in two stages. The first of these is operated at 400C, mainly to convert COS. Completion of the H_2S conversion is achieved in a second reactor, which is operated at 200-230C. Indeed, the low-temperature stage may itself be carried out in two successive reactors, with intermediate sulfur removal. Such a three-stage approach permits sulfur recovery as high as 99%. The higher investment cost occasioned by the third stage can, however, rarely be justified on the grounds of pure economics. Instead, three-stage sulfur recovery is sometimes practiced where air pollution limitations are very stringent.

Because conversion is limited to equilibrium at the dew point, yield can be greatly boosted by removing sulfur product at some point preceding the finishing stage. For example, expected yield in a two-stage unit without intermediate sulfur removal is of the order of 93% (starting with concentrated H_2S). By employing three stages, with sulfur removal following the first catalyst bed, sulfur recovery can be raised to 98-99%.

Another approach to lowering the dew point is to dilute the H_2S content of the feed gas to the catalyst cases; e.g. by recycling part of the plant's tail gas. A process based on this principle has been developed by Great Lakes Carbon Co. for the recovery of sulfur from concentrated H_2S.

Cooling and Recovery Stages. The thermal stage of sulfur conversion is responsible for effecting all of reaction (2) and about 70% of reaction (3). Nearly 90% of the total heat of reaction is evolved at this stage, and a flame temperature of 1300C is reached.

The heat generated in the thermal stage is employed universally to raise steam. In typical performance, 2 to 2.5 lb of high-pressure steam is obtained per lb of sulfur recovered in the plant. The thermal reaction itself is carried out in the boiler proper or in a separate reaction chamber from which the hot product gases are fed to a boiler.

The thermal reactor gas is cooled in economizers and aftercoolers and leaves the boiler system at 275-400C. The stream may be taken at this temperature directly to the catalyst cases. In some process designs, however, intermediate sulfur removal is interposed at this point and this is effected by cooling the gas well below its dew point (generally below 130C). In such instances, the gas, which has been partly freed of elemental sulfur, must be reheated to 190-400C before it is introduced into the first catalytic converter stage.

Cooling of the gas between catalyst stages may be effected by means of shell-and-tube heat exchanger. The heat exchange medium may be feed water taken to the boiler; or the sensible heat of the gas stream may be used to generate low-pressure steam.

Where this secondary cooling step is to be combined with sulfur removal, an effective method is to feed the process gas stream to towers in which it is scrubbed by means of liquid sulfur. In the course of this scrubbing operation, the temperature of the gas is lowered and sulfur temperature is correspondingly increased. The sulfur stream is then passed to an external waste-heat boiler where it gives up its sensible heat to generate low-pressure steam.

In all, about one lb of low-pressure steam per lb sulfur can be generated by the various gas-cooling steps following the waste boiler in which yield of high-pressure steam is 2-2.5 lb/lb sulfur.

Recovery of sulfur from the various gas streams takes one of two forms: condensation in tubular heat exchangers, and scrubbing with liquid sulfur.

The first of these methods calls for the use of heat exchange equipment followed by cyclone separators.

More popular in commercial practice is the technique of scrubbing by liquid sulfur in vertical towers. The towers are commonly of mild steel and may be either round or rectangular in cross-section. Some form of distributor bars are provided internally. Close temperature control between 120 and 150C is essential. This is the range in which sulfur exhibits its minimum

viscosity. Thus, the melting point of the sulfur is 115C and the viscosity range between 120 and 150C is 7-12 centipoises.

This compares with a viscosity of 100,000 centipoises for sulfur at 188C.

This need to operate within a narrow temperature limit makes it necessary to employ high sulfur circulation rates and to cool sulfur condensers with hot water.

For the same reason, also, all equipment handling liquid sulfur must be steam-jacketed or provided with steam coils. Transfer lines must be jacketed with 30 psig steam.

The preferred way to handle product sulfur is in the liquid state. It may be pumped into insulated tank cars which are provided with steam coils, and hauled therein to the market. Alternatively, the sulfur may be solidified on cooled belts or flaking drums and the resulting flakes loaded into box cars.

Inventory storage of sulfur is usually carried in solid form. The liquid product is pumped into large vats or pits where it is allowed to solidify. When it is needed, the mass is then broken up by blasting or crushing and the resulting large lumps of sulfur are shipped as such.

Some Developmental Sulfur Recovery Processes. Sulfur recovery from sour gas is carried out commercially according to several process schemes, all of which are however based on the same fundamental reaction systems, and all of which incorporate the principles outlined above.

Townsend[2] points out that today's commercial sulfur recovery processes are really aggregates of two or three separate processes, to wit: acid gas removal, sulfur conversion, and residue gas dehydration. In general, a daily sulfur producing capacity of ten tons is considered to be the lower size limit for economic operation of this type of process.

To make sulfur recovery economically available to smaller units, Townsend proposes a method in which gas sweetening and sulfur conversion are carried out simultaneously. The method is insensitive to the presence of carbon dioxide in the feed gas and is thus proposed particularly for instances where the feed gas is rich in carbon dioxide or hydrocarbons.

Underlying Townsend's process is the reaction of sulfur dioxide with hydrogen sulfide, i.e. equation (2) of the Claus process. The reaction is carried out in liquid medium, using triethylene or diethylene glycols, containing 2-5% water. While water acts as catalyst in the reaction, its presence in high concentration decreases the rate of reaction and it is for this reason that the upper limit of the reaction medium's water content is set at 5%.

The sulfur-forming reaction itself results in water formation. In order to hold moisture concentration within the permissible limit, it is therefore necessary to employ a high ratio of liquid medium to hydrogen sulfide feed.

The reaction as well as the gas sweetening operation is carried out in an absorption column. Sour gas or hydrogen sulfide concentrate is the gaseous feed. The scrubbing medium is wet triethylene or diethylene glycol.

Sulfur dioxide is introduced into the reactor column in the form of a dilute solution in the glycol medium. This solution is prepared in an auxiliary absorber in which sulfur dioxide (formed by the combustion of sulfur or of hydrogen sulfide) is contacted with recycle glycols solution.

The sulfur-dioxide-laden glycols stream is passed to the top of the reactor column. Reaction between sulfur dioxide and hydrogen sulfide in the gas stream is almost instantaneous upon contact between the two phases. The exothermic reaction causes the scrubber medium to warm up so that the temperature in the reactor increases toward the base. This gradient permits maximum reaction rate near the reactor bottom, while it facilitates completeness of the reaction and minimizes sulfur dioxide loss from the circulating liquor at the relatively low temperature (30-40C) which prevails at the reactor top.

Even so, some sulfur dioxide is unavoidably stripped from the glycols solution and is carried from the top of the reactor with the sweetened dry residue gas. In order that this may not result in sulfur dioxide loss, an auxiliary scrubbing column is provided in which the exit gas is contacted with a side stream of concentrated, SO_2-free glycols en route to the reactor top.

Leaving the bottom of the reactor is a slurry of (insoluble) sulfur in the glycol medium. This stream is heated to about 130C and is taken to a settler where liquid sulfur is allowed to separate from the glycols. Sulfur is withdrawn from this settler and is taken to the product handling facilities. The glycol layer, on the other hand, is drawn off and is reconcentrated and cooled for recirculation to the SO_2-absorber column and thence to the reactor proper.

The process is applicable to recovery of elemental sulfur either directly from sour gas or from hydrogen sulfide concentrate. In handling these different types of gas, essentially the same process principles are observed, although there are some minor variations in process flow. A key aspect of using hydrogen sulfide concentrate is the possibility of producing sulfur dioxide satisfactorily by burning approximately one-third of the feed gas. In sweetening sour gas by the Townsend method, sulfur dioxide is provided by burning one-third of the product sulfur.

Diethylene and triethylene glycols act, of course, as drying agents. Thus, in this process, the three operations of hydrogen sulfide removal (sweetening), hydrogen sulfide conversion, and gas dehydration take place in the same step.

In the commonly used gas sweetening operations, the scrubbing medium is alkaline and will thus remove both hydrogen sulfide and carbon dioxide from the feed gas. In the Townsend process, on the other hand, the reaction medium is essentially neutral and the system is thus insensitive to carbon dioxide. This aspect is an advantage in many instances. It provides, however, a drawback if the carbon dioxide content of the sour gas exceeds the limit permitted by pipeline specifications. In such an event, it is necessary to provide a separate alkaline scrubbing operation for removal of hydrogen sulfide together with carbon dioxide. Sulfur conversion is then applied to the H_2S concentrate.

As long as single-stage operation (i.e. without auxiliary CO_2 separation) is possible, the Townsend method shows reportedly[2] an economic advantage over the commercially established amine-water process for acid gas removal at CO_2 concentrations in the feed which exceed one percent.

The Atlantic Refining Process. Some process details of *another liquid phase* process for sulfur recovery have recently been made available by Atlantic Refining Co.[3] In this process iron chloride acts as oxygen carrier. Conversion of hydrogen sulfide is effected by reaction with ferric chloride, according to the equation:

$$2\ FeCl_3 + H_2S = 2\ FeCl_2 + S + 2\ HCl \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Ferrous chloride is reconverted to the ferric form by contact with molecular oxygen. The reoxidation of the carrier must be effected at a pH above 7 if adequate reaction rates are to be attained. In order to prevent precipitation of insoluble ferric hydroxide in alkaline medium, the iron is tied up in the form of a chelate, namely as ferric versenate.

The conversion of hydrogen sulfide to sulfur may be effected in the system by simultaneous introduction of H_2S and air. This is the approach proposed when the feed is concentrated H_2S.

On the other hand, if the feed is a hydrocarbon gas containing only some H_2S, a two-step operation is necessary in order to prevent contamination of the sweetened product gas. In such a process, H_2S is contacted with aqueous ferric versenate and the resulting ferrous versenate is passed to a second chamber where it is reoxidized in contact with air.

Performance at typical operation conditions is shown in the following table:

Oxidation of H_2S by Ferric Versenate	
Solution	Ferric Versenate
Moles Fe	0.0941
Molarity	0.628
pH	8.5
Temperature (C)	30
Time (hrs)	3.0
H_2S (M/hr)	0.048
O_2 (M/hr)	0.79
Moles Sulfur ÷ Moles Oxidant	1.49
M% Sulfur Rec'd.	97.0
M% Fe+++ of total Fe	97.0

Elemental sulfur is formed in this process as a finely defined solid which settles

(Continued on page 122)

Just the Trick for Drilling Rigs

Wherever there are drilling fields in the world diesels will be found doing their job — many of them Mercedes-Benz diesels.

Why? There are four good reasons: First, the Mercedes-Benz diesel program embraces 24 types with horsepowers ranging from 17 to 3000 h. p. It therefore provides the practical solution to every actual power problem.

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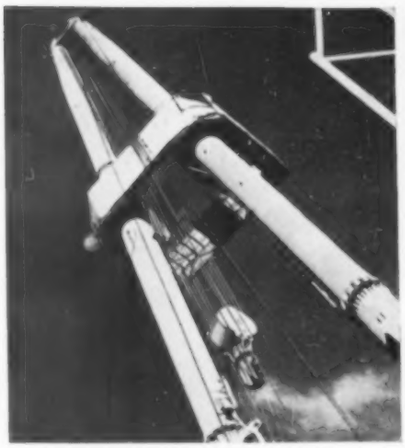
Therefore, Mercedes-Benz diesels offer all the features required for truly economical, reliable operation at the derrick.



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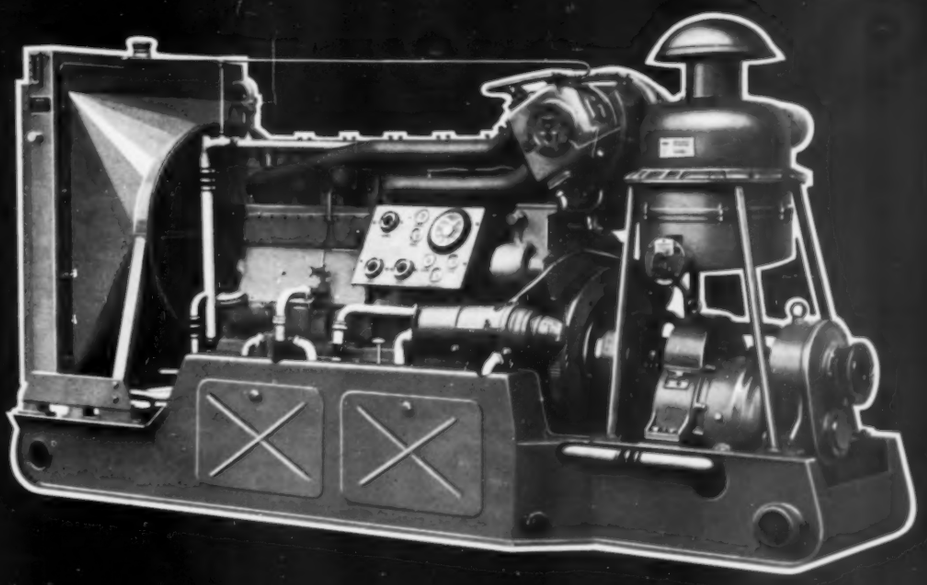

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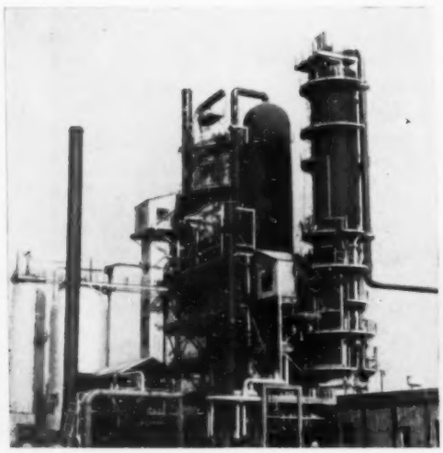
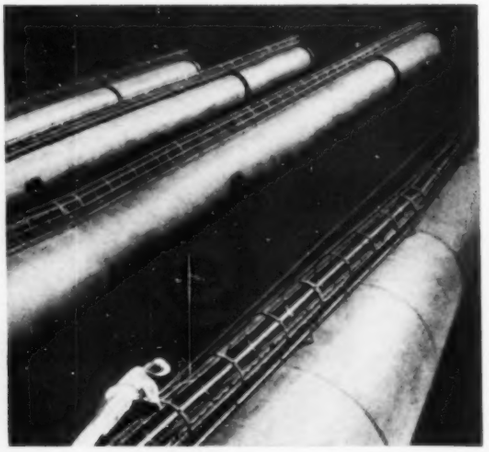


Montreal refinery. Regenerator towers gunited

Kwinana refinery. Towers gunited



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THIS CHIKSAN MARINE LOADING SYSTEM INCREASES FLOW CAPACITY, REDUCES OPERATING COSTS FOR UNION OIL

What you see in the photo above is a Chiksan Marine Loading System on a new multi-million dollar supertanker terminal at Los Angeles operated by Union Oil Company of California. Designed to speed unloading operations, this Chiksan System has five 12 inch by 52 foot arms, three normally in crude oil and two in bunker oil service.

Each arm is capable of handling 15,000 B/H of refined product and up two 11,000 B/H of crude; a greater capacity than any method previously used by Union Oil.

Translated into faster turn around time, this increased flow capacity coupled with other savings through such factors as improved safety conditions results in significantly lower operating costs for Union Oil.

Plan now to install the Chiksan Marine Loading System at your terminal. For full information and recommendations, contact Chiksan.

100-105 PSI ACROSS THE RAIL is safely handled by the Chiksan all metal arm. In addition, smooth interior diameter reduces turbulence permitting more efficient pumping flow.

CLEAN, COMPACT DESIGN has permitted substantial construction savings in some cases through use of smaller docks to house equipment, and outboard dolphins to handle mooring lines.

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Same day service speeds well data to users

THERE'S A NEW well data idea at work in the Rocky Mountain region.

Its function is to obtain maximum data on each well drilled in the Rocky Mountain states and move it to the proper people in the shortest possible time, the most useable form, and at minimum cost.

In this new system, information moves from field to user as shown in the flow diagram, and it can reach the user in one day, depending upon whether telegraph, mail, or a messenger service is used in the final connecting link.

The new idea is Well Record Service division of Petroleum Information Corp. PIC is in its 32nd year of publication of one of the oldest and most widely known Rockies region oil reporting services.

Operations started October 1 with nine client firms. Total Rocky Mountain drilling is covered in a manner and to an extent worked out by PIC.

Well Record Service preserves the personal contact, on-the-spot aspect of traditional field information collection and it supplements it with machine technology. The equipment used includes mobile telephones and radio in the field, high speed teletype, electronic data processing, and rapid reproduction. It moves data collected each day to the client companies the same day, and to other company locations as selected by the client.

Larger operators now using conventional methods of gathering and exchanging information in the Rockies could save upwards of $1 million annually through WRS, according to PIC president, Maury Goodin, one of the four brothers who own the firm. This estimate is based on direct costs, and does not include the many indirect costs which will be reduced by "automation" of the mass of clerical work now done in each company.

Existing PIC offices and facilities, plus knowledge of the region, helped in the creation of a working organization for Well Record Service. WRS functions as a separate division, and PIC reports continue as in the past. However, common management and physical facilities are employed.

Headquarters for WRS is Denver. District offices are at Casper, Billings, and Durango, and a district organization is maintained also at Denver. Working out of these locations is a field force of 12 reporters under supervision of district managers.

Well data is acquired by personal visit to drilling operations, contact with operator offices, and constant contact with governmental agencies of all types.

Each field reporter is equipped with a mobile telephone or radio. Working on a carefully scheduled basis, he reports daily on important drilling operations to his district office.

At the district office, teletype tapes are cut, data is coded and the information transmitted daily to Denver. Tapes punch their data on IBM cards and these are accumulated from all districts.

By 3:00 p.m. each day, material from all field offices has been assembled, processed, printed out for distribution in Denver, and cut back into tapes for transmission in a prescribed form to the district offices. As fed back to district offices, it is reproduced and sent by messenger to client offices in each district office city. If desired, a client can get each day's data by teletype to any location; or he can use mail.

Daily reports include all new locations announced, all reported completions, and the current status of wildcats. In addition, there is a constant flow of information on infield wells. Data to complete maximum information files on wells already completed and dropped from the daily reports is also acquired continually and moved steadily to Denver. Each week, a complete summary of all information is given each client, replacing a summary for the previous week, but without deletion of any information on active projects. Further, complete reports are made on workovers, deepenings and abandonments as they occur.

The method seems simple, yet its complexity required some four years of research. It depends on skilled field personnel so that WRS reporters were chosen from applicants with wide experience. Some WRS reporters have more than 15 years' experience in field information work for the oil industry.

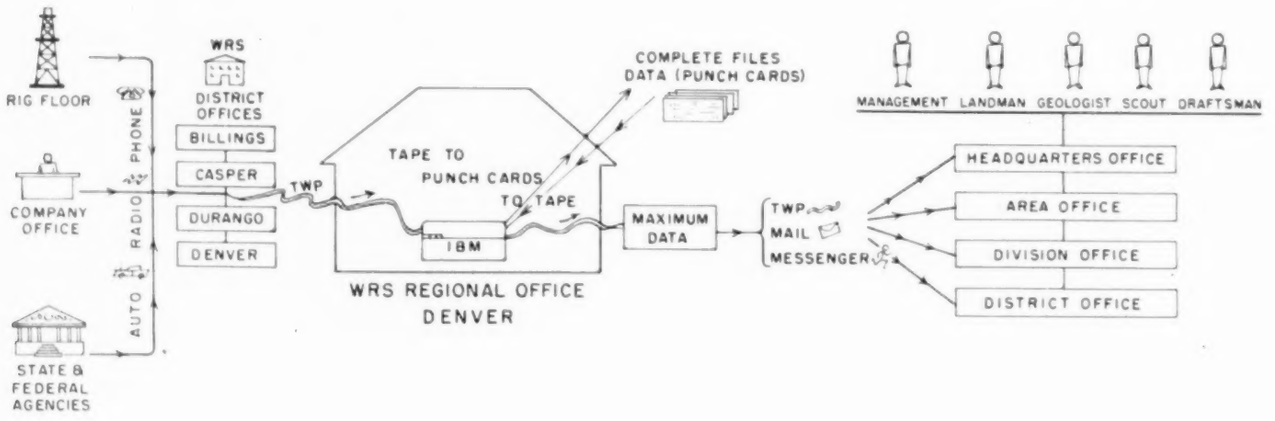
Data as provided the user is more accessible because it is in a standardized format and presented in the most useful form. The entire effort of WRS does not go as one unit to a single individual within each firm for his subsequent routing. Rather, it reaches the subscriber at designated points, according to each company's plan of use. One man may get the entire new location list, another the current status report, and still another the list of completions. Thus, the data which each man will use are presented in the most readily available form for his own use.

This procedure has been worked out with the industry advisory committee, and weight has been given to each individual client's operating requirements.

Within WRS files, and if desired, within client files, all well data from the Rockies region may be arranged on punched IBM cards, with all the categorization and special application inherent in the system already available.

The WRS operation is readily adaptable to data as generally reported. The system, however, was predicated on the request for maximum data. As a result, the available history

(*Continued on page* 122)



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Oil and water go together

at Mannesmann-made steel islands

Modern super-tankers, up to 100,000 tdw., have grown too big for many harbors. In recent years Mannesmann has been remaking the coastline with such tanker discharging facilities as the new installation a mile off the Sicilian shore, where two 65,000 - tonners can unload at the same time. Another island is four miles out to sea.

Under-water pipelines carry the oil ashore to neighboring refineries. Foundation piles and mooring dolphins of Mannesmann seamless and welded tube assure safety and stability in all weathers.

Speaking of mooring, the new Liverpool tanker discharging installation is flanked by Mannesmann steel tubular dolphins each over 5 ft. in diameter, 124 ft. long, and weighing more than a hundred tons.
Where oil has to pass through water, Mannesmann turns the trick.

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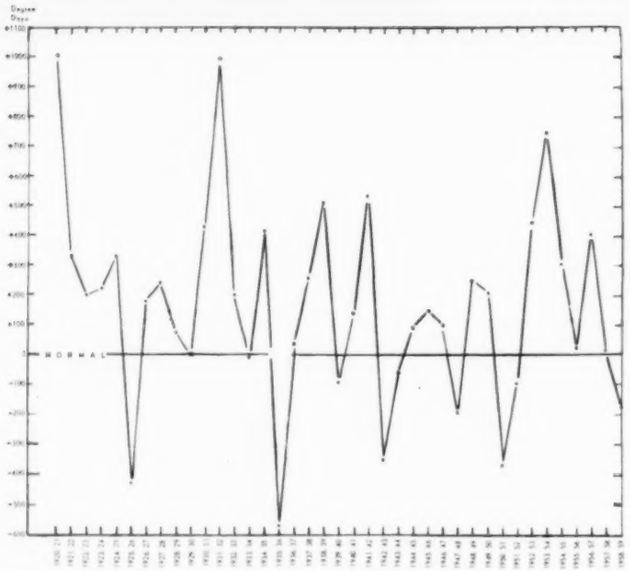

Fig. 1—Fluctuation of degree/days from Normal, at Chicago Midway Airport for six-month period October-March, from 1920 to 1959.

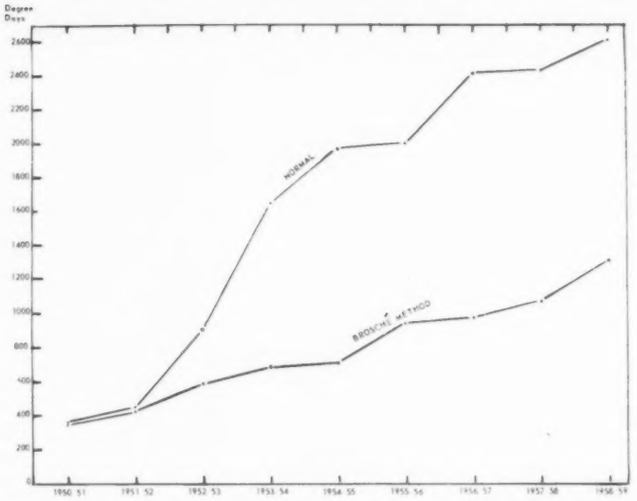

Fig. 2—Cumulative error (ignoring algebraic signs) of Broschè Method forecasts vs "Normal" degree/day, for October-March, at Chicago, from 1950 to 1959.

How to improve degree day forecasting

by Lyle E. Broschè*

More profitable, more efficient operations in fuel oil sales and distribution can be achieved with dependable, long-range weather predictions.

WHEN THE OUTSIDE temperature, in the shade, falls below the level of 65 F, the average household is presumed to require heat for human comfort according to heating engineers.

At this point fuel oil sales begin to mount, and every degree the mean daily temperature falls below 65 F there is recorded what is known in fuel oil circles as a "degree/day". If we assume the average small home will burn a gallon of fuel oil for approximately every five degree/days, a city of one million homes at a mean temperature of 30 F would consume approximately 7 million gallons in a single day.

There is little wonder then that the fuel oil industry is vitally concerned with temperature. The difference between a slightly warm and slightly cold winter can mean many millions of dollars to an average size company. When decisions must be made months ahead of a heating season with a large question mark on anticipated temperature, a great waste of money can frequently result.

This waste of money is attributed to a reluctant practice of using "Normal" temperature as a basis for planning, which seldom falls even close to the actual observed temperature, or the degree/day total. Preparation of budgets, estimation of revenue, manufacturing decisions, and in particular distribution and supply planning usually fall wide of the mark. By midwinter there can be great confusion within the company as to just which course to follow. Figure 1 illustrates the wide fluctuations of seasonal degree/days at Chicago over almost three decades. It points up the high departures from Normal, or large errors experienced in using the Normal for planning purposes.

The chart shows that in 59% of the cases since 1920 the observed total degree/days varied 200 or more from the normal, and 28% of the time the variance was 400 degree/days or more from normal. Relating this to just one million homes, an error of only 400 degree/days would add up to roughly 80 million gallons of fuel oil over a single October-March period. An infrequent error of 1,000 degree/days would amount to 200 million gallons. To carry this further, it is not uncommon for such a variation to occur over as much an area as half the United States and in such event the discrepancy in gallons would be astronomical.

To cope with the inherently high error frequency experienced with Normals, fuel oil companies must cushion against the possibility of at least normal temperature for the heating season to avoid to some extent depletion of stocks. The required extra inventory ties up huge amounts of capital; thus tankage and other costs spiral upward. Anything colder than normal for the season causes near panic conditions in hurriedly acquiring additional stocks. All

(*Continued on page* 126)

*Mr. Broschè, head of Broschè Method, Dearborn, Mich., has been a meteorologist for the past 24 years, a major part of the time with Pan American World Airways and with the U.S. Weather Bureau concerned with forecasts for transoceanic air transportation. A member of the American Meteorological Society, he has received two National Awards for achievements in his field.

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OIL COMPANY STAFF CHANGES

J. B. Nunn

C. O. Tongberg

JOHN B. NUNN has resigned from Sunset International Petroleum Corp. to become an independent broker for oil and gas leases and production at Denver, Colo. He was a vice president and director of McRae Oil & Gas until its merger with Sunset. Since the merger in July, 1958, Mr. Nunn has been mid-continent area land manager for Sunset International.

OSCAR B. LEWIS, vice president of Ethyl Corp. of Canada Ltd., has retired after serving Ethyl in the United States and Canada for 32 years. Mr. Lewis joined Ethyl in 1927 and subsequently represented the Company in New England, the Midwest and Great Britain.

ROLAND C. SHAW, vice president-Eastern Hemisphere, of Texfel Petroleum Corp., Dallas, has been elected president, director general of Texfel's French subsidiary, Transworld Petroleum, S.A.F. Transworld is presently engaged with its French partner, Societe de Prospection et Exploitations Petrolieres en Alsace (PREPA), in the exploration of four permits in metropolitan France.

Mr. Shaw was formerly vice president of Foster Petroleum Corp. of Bartlesville, Okla. and had been an officer of Cornell Oil Co. of Dallas.

JOHN C. MEEKER has been appointed division exploration superintendent, Pan American Petroleum Corp., replacing **ALVIN R. WINZELER**, who was transferred to Pan Am's Texas-Louisiana Gulf Coast division, exploration superintendent. **MICHAEL R. WALLER** has been promoted to the position of Canadian division geologist, the title formerly held by Mr. Meeker.

Dr. CLIFFORD W. SEIBEL, formerly assistant director of the U. S. Bureau of Mines in charge of helium activities, has joined The Stearns-Roger Mfg. Co., Denver, Colo., as a full-time consultant.

HERBERT F. DEFENBAUGH, division production superintendent at Midland, Texas, for Sinclair Oil & Gas Co., has been elected vice president for production and has moved to Tulsa. He will succeed F. H. Rhees, vice president and director, who has been promoted to operations coordinator.

O. L. STONE, presently a general attorney, has been named to handle exploration and production and industrial relations legal matters for Shell Oil Co. **S. R. VANDIVORT**, an attorney at head office, New York, has been named a general attorney. He will handle manufacturing, transportation and supplies, marketing, purchasing-stores and public relations legal matters. R. M. Hart, also an attorney at head office, has been named a general attorney and will handle legal matters concerning financial, including taxes, the secretary's office, personnel, including benefit plans and Shell Development Co.

ALBERT BENJAMIN has been appointed Latin American division manager for the employe and public relations department of Texaco Inc. His headquarters will be in Caracas, Venezuela.

HENRY LA COSSITT has been named its public relations representative in Washington, D. C., for Gulf Oil Corp. He will have offices at 1001 Connecticut Avenue, N. W. Among his duties will be a bi-weekly analysis of political news in terms of Gulf's interests. He also will direct the information and education part of Gulf's proposed program to give its employees an increased awareness of their country's legislators and legislation.

DR. CARL O. TONGBERG has been elected executive vice president of Esso Research and Engineering Co. He has been president of Jersey Production Research Co., Tulsa, since April, 1958.

J. H. RENARD, executive assistant to the president, Sinclair Pipe Line Co., has been elected vice president, a director and a member of the executive committee to succeed C. F. McCoy.

F. WILLIAM SCHUMACHER, manager of Esso Standard Oil Co.'s Everett (Mass.) refinery, has been named petroleum research coordinator, a new post, at Esso headquarters in New York City. **WILLIAM J. SHERIDAN**, operations superintendent at the company's Bayway Refinery, Linden, N. J., will succeed Mr. Schumacher as Everett refinery manager.

I. J. REED, assistant manager, exploration department of Arabian American Oil Co. (ARAMCO), has been appointed manager, exploration department in the Saudi Arabian offices.

J. E. WILSON, acting Houston area exploration manager for Shell Oil Co., will succeed **E. D. CUMMING** when Mr. Cumming retires at the end of this year.

FRANK B. MARKEL, WAYNE V. JONES and **DANIEL B. LOVEJOY** have been elected senior vice presidents of Union Oil & Gas Corp. of Louisiana. **DONALD K. HAWES**, formerly secretary and assistant treasurer, was appointed secretary and treasurer. **MAXWELL L. EUWER**, vice president, was named general manager of domestic production; **ELLIOTT H. POWERS**, vice president, is now general manager of domestic exploration, and **WILLIAM H. WOODS**, vice president of Runnels Gas Products Corp., a wholly owned subsidiary, is now general manager of the parent company's Gas Department.

HARRY JEFFRIES, director and executive vice president of Sinclair Oil Corp., has been elected also as chairman of the finance committee, a new post. **IVER J. BERGHOLT**, since 1955 assistant treasurer and vice president, has been elected treasurer. He succeeds **W. F. DAU**, retiring October 1.

HENRY M. HANBURY has been named general manager of the foreign operations department (Western Hemisphere and West Africa) of Texaco, Inc. He succeeds **LANDON B. DERBY**, recently elected vice president in charge of the department.

L. T. WILSON, manager, Montreal East Refinery, Shell Oil Company of Canada, Ltd., announces the appointment of **R. K. MacINTYRE** as chief engineer. He replaces **J. S. BALL** who is transferring to the position of manager of fire, safety, utilities and effluent control department.

DAVID PROCTOR has resigned as chairman of Gulf Oil Corp., after a distinguished career of over 40 years with the Gulf companies. **R. O. RHOADES**, a director and executive vice president, has been elected to succeed Mr. Proctor as chairman.

Mr. Proctor joined Gulf on April 1, 1919 and rose to lawyer.

DONALD B. WINFREY has been appointed assistant to the president for Petty Geophysical Engineering Co. He has been with Cities Service Petroleum, Inc., as exploration manager in Venezuela and chief geophysicist for their foreign department for the past two years.

D. B. Winfrey

Ken Davis, Jr.

R. C. Curtis

H. A. Jarvis

R. C. CURTIS, president of Jersey Production Research Co., and **HARRY A. JARVIS**, executive vice president of Creole Petroleum Corp., have been elected to the board of directors of Esso Research and Engineering Co. All firms are affiliates of Standard Oil Co. (New Jersey).

R. L. INGLISH, regional operating superintendent in the southwest division, has retired after over 40 years of Sun Oil Co. service. He is succeeded by **H. P. ASTON.**

R. C. FAULKNER, director-mechanical design and construction in the Pittsburgh office of Gulf Oil Corp., has retired effective October 1. He has been with Gulf since 1923.

JOHN S. SPROWLS has been named vice president and assistant to the president of The Vickers Petroleum Co., Inc., Kansas independent. He was formerly assistant treasurer of Gulf Oil Corp. in charge of Loans and Related Investments.

F. H. RHEES, vice president and a director of Sinclair Oil & Gas Co., Tulsa, has been promoted to operations coordinator, a new post. Mr. Rhees will serve as coordinator for production, gas and gas products, liquefied gas products sales, engineering, property acquisition, part interest, and motor transportation and mechanical maintenance.

CARROLL J. BROWN has been named executive development advisor of Standard-Vacuum Oil Co. He succeeds **LAWRENCE C. HAMLIN** who recently was appointed regional vice president in charge of the company's Far East operations. Mr. Brown holds a master's degree in industrial management from Massachusetts Institute of Technology. For the past five years he has served Standard-Vacuum on a full-time basis as organization consultant. In this capacity he has participated in management studies in Indonesia and Africa and has helped shape the company's executive development program.

New supervisors at Tidewater Oil Co.'s Delaware refinery are: **EDWIN J. HOFFMAN**, supervisor of the crude processing area; **WILLIAM J. DOYLE**, unit technical foreman of the alkylation-polymerization area; **GEORGE M. ROSE**, unit technical foreman of the cracking area; **LAURANCE A. GLEASON**, unit technical foreman of the utilities and sulfur recovery area; **CHARLES W. McCLOUD**, unit technical foreman of the coking area, and **CLARENCE E. SLATER**, senior engineer in the engineering department.

REXFORD S. BLAZER, chairman of Ashland Oil & Refining Co., has been elected president of the National Petroleum Association at the organization's 57th annual meeting in the Hotel Traymore. He succeeds Guy B. Hunter, chairman of Quaker State Oil Refining Co. John E. Selden, president of the South Penn Oil Co., Oil City, Pa., was elected vice president. New second vice president is L. E. Kincannon, executive vice president, Rock Island Refining Corp., Indianapolis, Ind.

New President for Loffland

Ken Davis, Jr., president of Kendavis Industries, Inc., International, has become president of Loffland Brothers domestic companies, with headquarters in Tulsa. Prior to joining Loffland Brothers several years ago, Mr. Davis was president of Unit Rig & Equipment Co. Oklahoma. Presently he is chairman of Unit Rig. Other Loffland Brothers changes include the promotion of J. O. Rundle as president of all Loffland Brothers foreign companies, and T. W. Wheeler as executive vice president of Loffland Brothers domestic companies.

"Let's do an abstract," said the artist for the hundredth time.
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ROBERT W. GERHARD, director of the distribution economics coordination division in the supply and transportation department of Standard Oil Co. (Indiana), has been appointed director of economic research of Societe Civile Amoco, the foreign market study group in Paris, France, for Standard. Mr. Gerhard will continue studies connected with the company's activities abroad initiated some time ago by John W. Boatwright, chief economist for Standard Oil since 1956. Mr. Boatwright, who has been on active assignment to Societe Civile Amoco for the past year, will retire effective Jan. 1, 1960.

Also effective Sept. 28 in the supply and transportation department of Standard Oil (Indiana) at Chicago, the distribution economics department will be reorganized, with **DONALD S. WARNING** manager of the distribution economics department, appointed director of marketing research. **HOWARD A. PARKER**, of New York, assistant to the general manager of manufacturing of American Oil Co., an affiliate, has been appointed manager of coordination and supply planning in the supply and transportation department at Chicago.

Jet Fuel Advance

A revolutionary development in jet aircraft fuel that promises to increase aircraft lifting power, extend nonstop flight range and engine life, as well as virtually eliminate exhaust smoke on take-off, has been announced by Texaco Inc. The advantage of the new Texaco jet fuel lies in what is described as its extremely low "luminosity," a property only recently discovered to be critical in jet aircraft fuels.

Texaco's new long-luminosity fuel sharply decreases the amount of radiant heat given off inside the engine's combustion chambers. The new fuel can thus be burned at higher temperatures than conventional fuels without overheating the engine. This means that the jet can develop greater thrust at take-off, increasing its lifting power and payload, and that it can run cooler in the air, increasing its engine life. Moreover, the new fuel virtually eliminates the exhaust smoke on take-off caused by conventional fuels.

International guests and speaker at the September meeting of the Los Angeles Chapter of Nomads. From left to right:—Deon Davidson of Baker Transworld from Venezuela; Jack Wilkinson of Basrah Petroleum Co. from Iraq; Frank E. Cauble of Western Oil & Gas Association, speaker; Al Dysart of International Brown Drilling Co. from Turkey; C. M. Williams of LTS from Algeria.

J. L. McBride Retires

J. L. McBride, division manager at Shreveport for Halliburton Oil Well Cementing Co., Halliburton, retired Sept. 1 after 38 years with the company. Travis Phillips, who has been division manager at New Orleans, was promoted from assistant manager to manager at the New Orleans post.

New Hughes Bit

A new rock bit designed specifically for soft top-hole formations is reported drilling up to 30% more footage and at 18% faster rate of penetration than bits previously used. The bit is the Hughes OSC-3A, a Tri-Cone bit designed and introduced by Hughes Tool Co. New OSC-AA features include an increase in tooth height, resulting in a deeper "bite," speeding penetration. Fewer number of teeth make contact on bottom, increasing the gouging-scraping action. Fewer heel teeth give more ventilation, increasing self-cleaning action.

Pipeline Equipment For Tunisia

A $250,000 shipment of pipeline construction equipment was recently sent to Tunisia by the M. J. Crose Manufacturing Co., Inc., Tulsa. Purchasers were GREP, the Entrepose Co. and the Soc. Parisienne pour l'Industria Electrique who are jointly engaged in building a 24-inch gas pipeline 476 miles long from Oekhira, Tunisia, to Edjeleh, Algiers. The shipment included automatic pipe double jointing equipment, cleaning and priming and coating and wrapping machines.

A year ago Crose shipped its first overseas pipe double jointing unit for use on the 300-mile oil line from Hassi Messaoud to Bougie.

Signal-Eastern States Merger

Stockholders of Signal Oil and Gas Co. have voted to merge The Eastern States Petroleum and Chemical Corp. into Signal Oil and Gas Co. Samuel B. Mosher will remain chairman and chief executive officer and R. H. Green will continue as president of Signal. R. B. Kahle, chairman, and R. N. Blaize, president of Eastern States, will become vice-presidents and directors. Signal will acquire a complete 60,000 b/d refinery, a petrochemical plant and a research center located in Houston; as well as deep-water marine terminals and an interest in the Rancho Pipeline which extends from West Texas to Houston.

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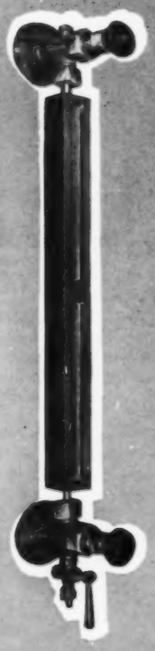

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Gasoline Refrigeration Brochure

Illustrated Bulletin 172, just issued by Clark Bros. Co., one of the Dresser Industries, presents a careful study of refrigeration systems in modern gasoline plants. It discusses the relative merits of vapor compression and ammonia absorption systems for both large and small plants. Special emphasis is given to important design, equipment and operating factors which influence the overall economics of any given system. Copies may be obtained by writing to Clark Bros. Co., Olean, N. Y.

Parkersburg Offices Move

Operating offices of The Parkersburg Rig & Reel Company have been opened in Houston, Texas. The new offices are located at 4801 Richmond Avenue. Spearheading the move to Houston along with Craig M. Rowley, executive vice president and general manager, are J. W. Robbins, vice president and general sales manager, and Fred King, manager of manufacturing of oil country products. Other departments of the Company are under study for possible future relocation.

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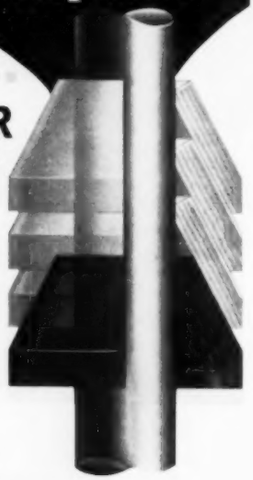

After months of exhaustive field tests, HERCULES is now including a NEW, SOLID Split Bottom Cone Packing Ring in each set of HERCULES Cone Shaped Packing Rings at no extra charge. This new Split Bottom Cone Ring is solid, providing greater contact with the polished rod and a more substantial base for the upper Packing Rings, resulting in longer packing life. A complete set of HERCULES Cone-Shaped Packing Rings now consists of three *Regular* and one new *Split Bottom Cone Ring* for greater life and superior performance.

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W. H. Armstrong

T. H. Patterson

Reed Roller Bit Appointments

W. H. Armstrong has been appointed Reed Roller Bit Co. regional sales manager for Oklahoma, Kansas and North Texas; and T. H. Patterson is now division manager with headquarters in Oklahoma City. G. M. Charleston has been named Reed Special Salesman in Oklahoma City. Mr. Armstrong formerly was division manager in Oklahoma City. His new headquarters are in Tulsa.

G. M. Charleston

J. F. Allen

Heads Pressure Control Division

Cameron Iron Works, Inc., has promoted J. F. Allen to manager of manufacturing of the pressure control equipment division.

Mr. Allen started with Cameron in 1949; he has since held various engineering management positions and in 1957 was promoted to manager of Cameron's guided missile plant.

Lee Fagg

L. C. Graves

Bethlehem Promotions

Lee Fagg has been appointed assistant manager of sales for Bethlehem Steel Co.'s supply division and L. C. Graves was named sales manager-subsurface production equipment. Both men will be located in Tulsa and will be under the direction of J. V. Spalding, general manager of sales.

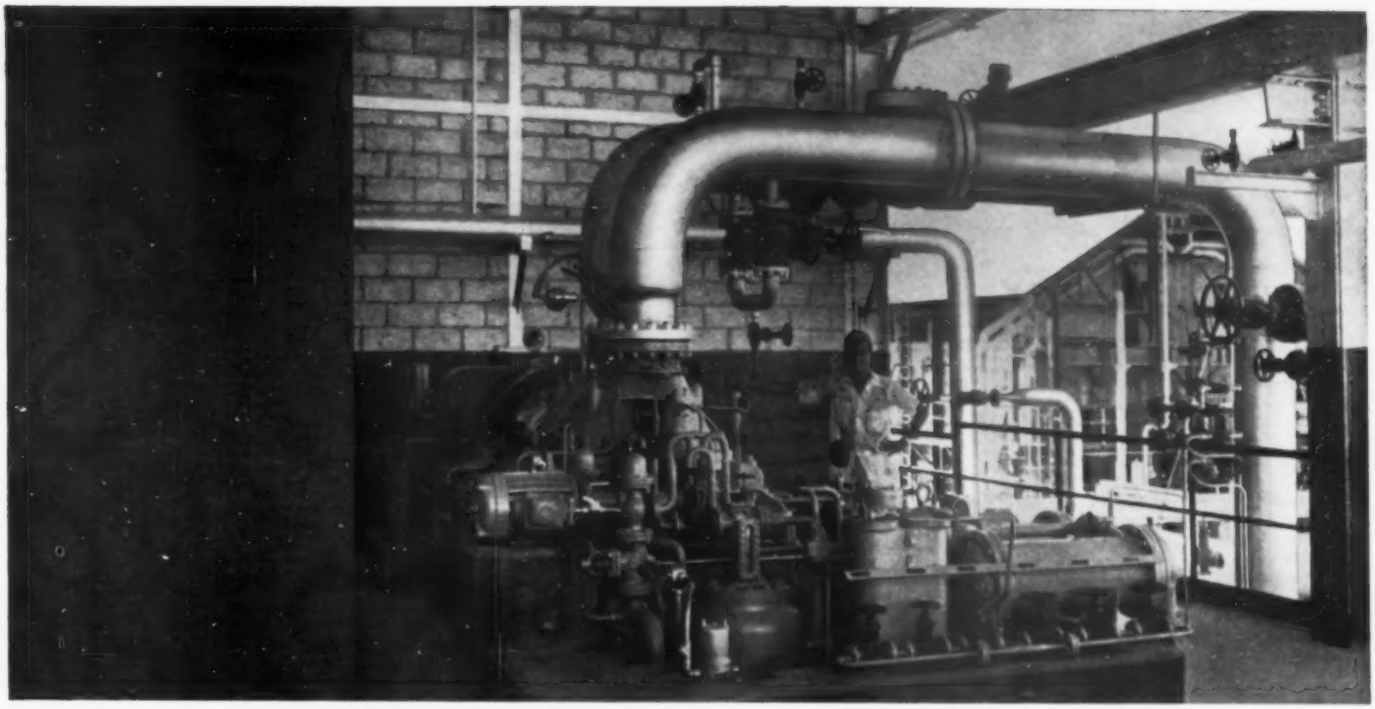
Lee Fagg is a veteran of 31 years in the oil industry. He has been manager of machinery sales for all Bethlehem supply division manufactured products, including drilling, production and pipe line equipment since 1948. L. C. Graves is another veteran of the oil field supply business for over 30 years and has been with Bethlehem since 1939.

HORACE B. HORTON

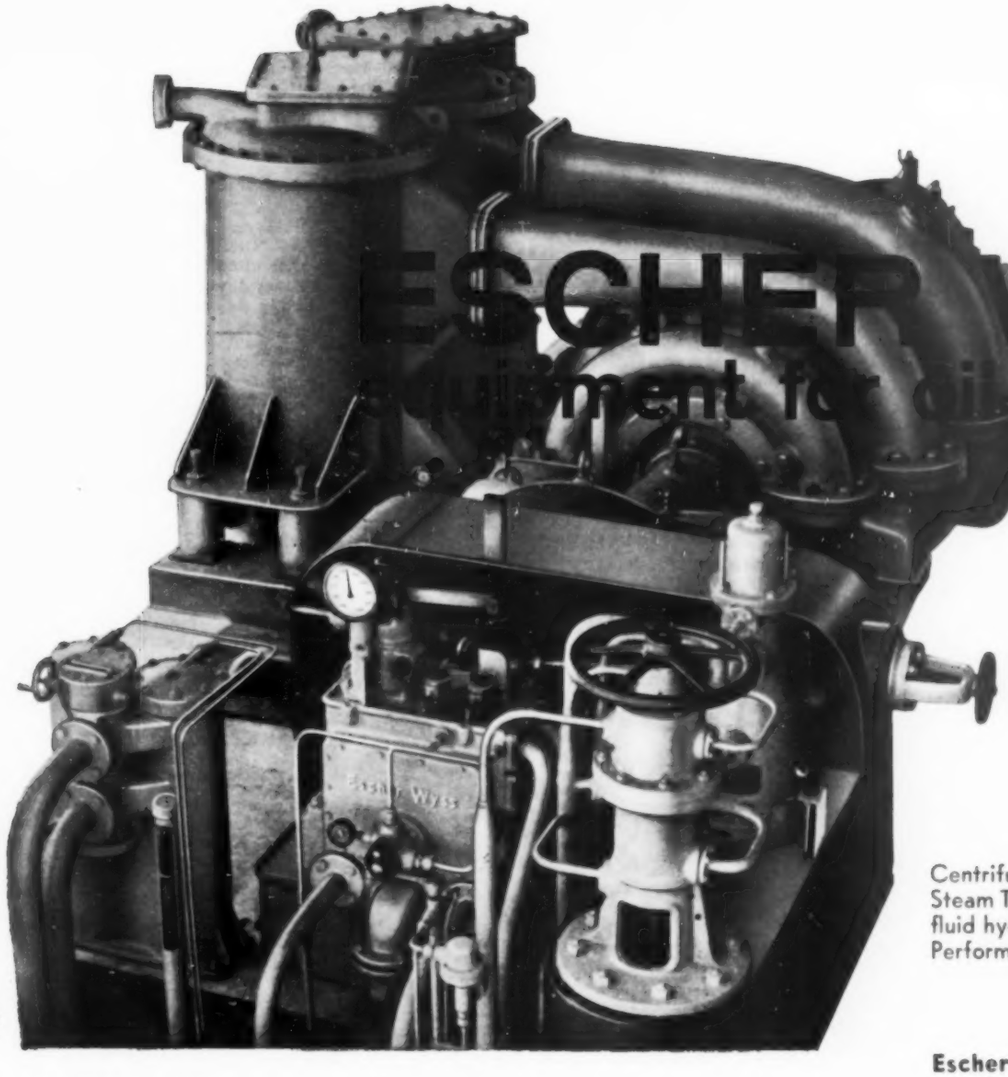
Horace B. Horton, chairman of Chicago Bridge & Iron Co., died September 17 in Chicago. He was 73 years of age. The oldest employee in length of service with the company, Mr. Horton joined CB&I in 1907. Five years later he was elected treasurer and a director. He was named president in 1945 and chairman of the board 11 years later. In addition to his duties with CB&I, he was a director of several subsidiary companies.

SID W. RICHARDSON

Sid W. Richardson, 68, died Sept. 30 as the result of a heart attack while vacationing on an island offshore in the Gulf of Mexico. Mr. Richardson won a fabulous fortune as a wildcatter and was credited as being one of the world's wealthiest men at the time of his death.



Centrifugal Recycle Gas Compressor with sealing oil system, installed in an oil refinery



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Centrifugal Compressor with Condensing Steam Turbine, supplying combustion air to a fluid hydroformer installed in an oil refinery. Performance: 11,250 cfm, 260 psia, 8150 rpm

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INTERNATIONAL NEWS AND NOTES

Italy's State Oil Activity

The Italian government's state oil agency, Ente Nazionale Idrocarburi and its affiliated companies, principally AGIP, has reported on its activities from May 1, 1958 through April 30, 1959.

In exploration, Agip Mineraria and its subsidiaries completed 131 wells in Italy and one in Somalia: 55 exploration and 77 development. Drilling totaled 249,150 meters. At the present about 20 wells are drilling.

Natural gas production of ENI totaled 4,822 million cubic meters, a modest increase of 137 million over 1957. In the first four months of 1959 methane production increased 9%.

Overall liquid hydrocarbons production of the group was 216,706 metric tons in 1957, up to 345,400 metric tons in 1958 (a 59% increase), due exclusively to the Gela development.

Production of Sinai fields (Egypt) in which Agip Mineraria is largely interested amounted to 1,802,896 metric tons, an increase of 137%. Last year (1958) Egyptian crude oil imported in Italy amounted to 1,124,884 metric tons. In Iran and Morocco geological and geophysical surveys are being carried out. The first wildcat in the offshore Iranian concession held by SIRIP (NIOC-ENI) will be drilled from a platform. In the second concession in the Zagros Mountains the first exploratory well will begin soon. In the third Iran concession an area partly offshore on the coast of Mekran, a geological survey has been completed and a geophysical survey is continuing.

Total length of gas pipelines operated by SNAM (Società Nazionale Metanodotti) was 4,124 km. against 3,938 at the end of 1957.

Preliminary work on the crude and fuel oil pipeline system to connect Genoa with Milan, Turin in Italy and Aigle in Switzerland started in May. Overall length is to be 600 km and capacity 10-12 million tons per year.

Two 36,182-dwt turbotankers, "Agip Ravenna" and "Agip Gela," were added to ENI the tanker fleet operated by SNAM. ENI fleet is now 13 units, totaling more than 190,000 dwt.

In 1958 crude refined was about 5.7 million tons, including 170,00 tons of domestic crude and 155,000 of Egyptian. ENI signed an agreement with Moroccan Government and established SAMIR (Sté Anonyme Marocaine-Italienne de Raffinage) at 50:50 to build and operate a 1.25 million ton refinery. The company will have the exclusive marketing in Morocco of the major oil products.

In petrochemicals, operations started in the ANIC Ravenna plant in new units to produce acetaldeyde, acetylene and butadiene from acetylene. The program includes setting up of a division to manufacture butadiene from butane, aimed at annual production of 60,000 tons of synthetic rubber. Sales of nitrogenous fertilizers and synthetic rubber were satisfactory in Italy and overseas.

Australian Oil Terminal

Vacuum Oil Co. plans a $450,000 oil terminal on Twofold Bay, near Eden, New South Wales. The terminal will provide a central distribution point for a wide area of the south-eastern N.S.W. district from the Bateman's Bay area to Cooma on the Snowy Mountains in the west.

Petrochemical Bids In Australia

Vacuum Oil Co. Pty Ltd. has called tenders for the construction of the first synthetic rubber manufacturing plant in Australia. The rubber-manufacturing affiliate, Australian Synthetic Rubber Co. Ltd., is owned jointly by Vacuum and Goodyear Tyre and Rubber Co. (Australia) Ltd.

Australia Plans Oil Restrictions

State Cabinet has authorized the Minister for Labor and Industry (Mr. J. J. Maloney) to prepare a bill to license gasoline stations, regulate their hours of trading and prevent wholesalers from enlarging the extent of their present direct participation in the retail distribution of gasoline and motor oils.

Oil Refinery For Mombasa

A refinery is to be built in the Changamwe industrial area of Mombasa under an agreement between Kenya and The Shell Co. of East Africa and BP East Africa. At the instance of the government, provision is made for the association of other companies in this project. No capacity figure is announced.

Hydrofiner For Porto Marghera

A hydrofiner of BP process design has been commissioned at the Porto Marghera refinery, near Venice. The unit is capable of substantially removing the sulfur from 6,500 b/d of gas oil and is associated with a sulfuric acid manufacturing plant. This is the sixth hydrofiner in BP group refineries.

ENI Mission In Ghana

A mission from ENI, The Italian government's company, has arrived in Ghana to study with the local authorities the possibility of a refinery in that country on a 50:50 basis. The capacity of the planned plant is unknown.

Gabon Discovery By Mobil

Two affiliates of Mobil International Oil Co. and Societe des Petroles de l'Afrique Equatoriale Francaise (SPAEF) have made an oil discovery in Gabon, Africa. The well, Rembo Kotto No. 1, produced 28 barrels of light gravity oil from a depth of about 2,000 ft. during a two hour drill-stem test. The indicated daily rate is 340 barrels. Mobil affiliates participating are Mobilrex and Mobil Exploration Equatorial Africa, Inc.

Under the agreement with SPAEF, Mobil affiliates have a 50% interest in the well. The Mobil affiliates have programmed for expenditures of $45 million (with a minimum of $22.5 million) during the six years agreement period which covers 6,175,000 acres in the Gabon and Congo republics.

Philippine Wildcat Begun

Philippine Oil Development Co. (PODC) and San Jose Oil Co., a 75% subsidiary of Pantepec Oil Co., C.A. and Pancoastal Petroleum Co., C.A., have begun drilling on their joint well, Tigbauan No. 1, on the island of Panay in the Philippines. The test well will be drilled to approximately 8,000 ft. on the crest of a seismic structure which is approximately three miles south of an exploratory well, Oton No. 1, drilled by PODCO in 1953 to a total depth of 6,354 ft. While Oton No. 1 was abandoned as a dry hole, it encountered shows of oil from sections between 3,926 ft. and 6,019 ft. in depth.

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ANIC Expansion

With petrochemical manufacture now underway from some of the units at the Ravenna, Italy, plant of ANIC, an ENI subsidiary, the company, with a 5.7% increase in net profits for 1958 over 1957 (from 647 to 687 million Lire), is now aiming at markets beyond Italy and Europe.

A market for AINC's nitrogenous fertilizers (750,000 ton/yr) is expected to be found in the Far and Middle East as well in Iron Curtain countries, with which fetrilizers-for-crude oil trades have been established. Export of synthetic rubber to Soviet area countries will also play an important role in the company's policy.

ANIC is now producing synthetic rubber with butadiene produced by the natural gas-acetylene-acetaldehyde route, and will also manufacturer from butane-butene mixtures. Process units are now under construction for butane-buten dehydrogenation to butadiene, as well as new facilities for urea and calcium nitrate.

On the immediate expansion program for ANIC is the utilization of Gela (Sicily) crude oil, not considered easy because of its high asphalt, high sulfur content. The problem is under study by ANIC in cooperation with U. S. companies.

The capital work of ANIC today is 7.2 billion Lire ($11.5 million), 53% of the shares being held by the Italian government, through ENI.

Shell Interests In Egypt

Responsibility for the affairs of the Anglo-Egyptian Oilfields Ltd., has been assumed by F. H. Frangenheim, the new managing director, following the handing back of the properties by Egypt. A board is to be formed in accordance with the new Egyptian company law and a meeting will be held to authorize the signature of the agreement between the United Arab Republic Government and the company initialled last December which settled past claims and laid down the basis for future operations. A full statement on this is to be issued.

Alaskan Wildcat Spudded

General Petroleum Corp. has spudded its second wildcat well on the Alaska Peninsula, Great Basins #2. The first well, Great Basins 1, was abandoned September 15 after being drilled to a depth of 11,080 ft. Great Basins 1 was spudded July 6. Great Basins 2 is located in the northeast quarter, section 2, township 26 south, range 50 west, about 14 miles northwesterly from the first well. Both wells are more than 350 miles west of Anchorage. Rowan Drilling Co. of Fort Worth, Texas, is the drilling contractor.

Shell Refinery In India Expands

The government of India has agreed in principle to the expansion plans of Burmah-Shell Refineries (Bombay) from 2.2 million tons per annum to 2.6 million tons (50,000 b/d). Later expansion is to increase refinery intake up to four million tons of crude oil a year, plus a lube plant to manufacture 50,000 to 100,000 tons a year.

New Pakistan Refinery

The Pakistani government has concluded a contract with four oil companies—Burmah Oil Co., Standard Vacuum, Shell and California-Texas—for a refinery in Karachi. The refinery will have an initial capacity of 1.5 million tons (30,000 b/d) with provision for later expansion. Cost is estimated at about 33 million dollars.

Indian Pipeline

The British firm of Stewarts and Lloyds is to supply a 280-mile pipeline from Nahorkatiya oilfields (Assam) for transport of crude oil to the new refinery that is being set up at Nunmati (Gauhati). This pipeline will be extended to the other government refinery at Barauni later, making a total length of 720 miles.

The Indian government recently accepted a credit of £13 million (36 million dollars) for part of the cost of the proposed pipeline from Assam oilfields to Barauni. This will supplement a credit of £10 million (28 million dollars) provided by Burmah Oil Co. under agreement with the government for construc-

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BRANCHES AND AGENTS THROUGHOUT THE WORLD

tion of the first stage of the pipeline from the oilfields to Gauhati. The British loan is to be repaid in 15 years. The Burmah Oil Co., the parent firm of Assam Oil Co., is the government's partner in the firm of Oil India Ltd. which is to explore and exploit oil resources of Assam. The British firm provides two-thirds of the Rs 500-million capital of the Oil Inida Ltd. and the government the other third.

Mobil Enters Puerto Rico

Mobil International Oil has announced plans to enter the gasoline market in Puerto Rico this year as part of its program of expanded activities in the Caribbean and Latin America.

Mobil International is a division of Socony Mobil Oil Co., Inc. The operation will be carried out by Mobil Oil Caribe, Inc., with headquarters in San Juan, Puerto Rico. The general manager will be J. N. Burrow, who is being transfered from Turkey to take over the new portfolio on October 1.

Oil Industry Organizes Own Group

A chamber of the petroleum industry recently formed in Caracas brings together oil companies, service and allied organizations. The new organization will carry out the functons normally inherent to such organizations and will seek to develop closer ties with all sections of national life, specially with government and such institutions as the Federation of Chambers of Commerce, production, industry and others. The board of directors is made up of seven members and corresponding alternates.

Names of the new organization's board were: Dr. Jose Giacoppini Zarraga (Compania Shell de Venezuela), president; Dr. Luis Alcalá Sucre (Mene Grande), vice president; G. Crickmay (Venezuela Atlantic and Refining Co.); Dr. G. Rodriguez Eraso (Creole Petroleum Corp.); Dr. Luis E. Arocha (Mobil Oil Co. of Venezuela); Arthur A. Curtice (Signal Oil Co.); and Richard Wright (Texas Oil Co.). Alternates are: Dr. Pedro Jose Mantellini, Florentino de Urarte, Dr. Francisco Alvarez Chacin, Dr. Luis G. Arcay, Dr. Cesar Rosales, Dr. Romulo Quintero and Ernesto E. Massimine.

Pure Suspends Paraguay Hunt

The Pure Oil Co. and associates have suspended exploratory drilling operations in Paraguay. The group headed by Pure's subsidiary—Pure Oil of Paraguay is retaining 3 million acres in the rugged northwest Chaco territory near the Bolivian border. There are no immediate plans for further drilling. Associated with Pure in the Paraguanan venture are Gulf, Sinclair, Tidewater and Williams Brothers Corp.

A total of four test holes were drilled at widely separated locations in the Chaco. The fourth test, the Mendoza No. 1 at 1,927 ft. encountered natural gas which was uneconomic to produce because of the well's remote location. It was deepened to over 10,000 ft. without discovering oil. These tests were extremely expensive and located in inaccessible jungle country necessitating a 200-mile access road. The drilling crew was attacked several times by Moro Indians.

Mobil Enters Chile

Mobil International Oil Co. has announced the formation of a new company in Chile which will be jointly owned by the Mobil organization and the Chilean oil products marketing firm, Compania de Petroleos de Chile, better known as Copec. Copec, owned entirely by Chilean private capital is the exclusive distributor for Mobil lubricants in Chile. Mobil Oil de Chile is now building a $975,000 lubricant-blending plant in the Pacific coast city of Vina del Mar. It will have an initial capacity of 78,000 barrels a year.

ANIC's Increase Of Capital

The ANIC, one of the companies of Italy's ENI group with interests in refining industry and petrochemicals, will increase its capital from 7.2 billion of lire (about 11.6 million dollars) to 36 billion lire (over 58 million dollars). ANIC participates 50% in the Leghorn and Bari refineries of Stanic jointly with Jersey Standard and owns the large petrochemical plant at Ravenna.

Oil Boycott to Haiti

Shipments of Venezuelan oil products to Haiti will be discontinued, according to the government, as evidence has been found that they are being transshipped to the Dominican Republic with which Venezuela has broken diplomatic relations. Venezuelan oil workers have repeatedly refused to load any tanker bound for either of the two countries, and it is believed that Aruban shipments will also be discontinued according to an announcement of the Federation of Oil Workers (Fedepetrol) which originated the boycott.

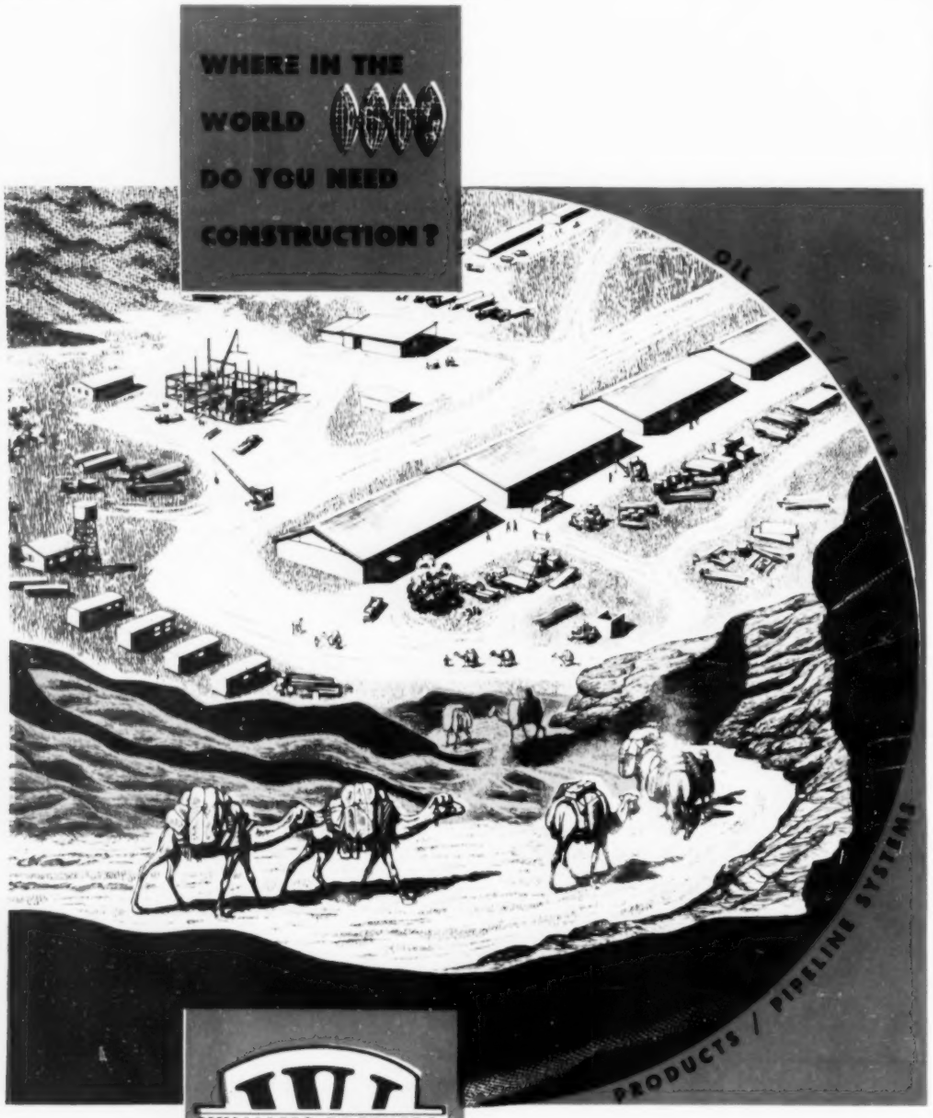
To Explore Paria Gulf

The Mining Oil Co. Ltd. of Trinidad will carry out exploration in the Gulf of Paria, Trinidad coastal waters and the adjacent submarine platform. The company has engaged Marine Geophysical Service Co. of Houston, Texas, for mapping the area. According to announced plans, exploration will extend beyond Trinidad's territorial limits and into Venezuelan waters. Agreements are to be worked out between the two governments.

Labor Moratorium

No Venezuelan oil worker can be fired until the end of the collective contract discussions, according to an agreement recently signed by the oil companies before the labor Minister Dr. Luis Hernandez Solis and retroactive to September 19. Workers laid off between that date and Sept. 24 will have to be re-instated and their cases reconsidered after the collective labor contract has been signed. The agreement was signed to allow contract talks to be carried out in an atmosphere of labor peace.

At present there are two minor conflicts: One with Richmond Exploration Co. involving 450 workers in the Maracaibo area, who have returned to work under protest by presidential decree, and one with Halliburton's 150 workers in the East which is still pending. The origin of both conflicts dates back to before the agreement, therefore they are not affected by it.



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Here's seaweed in your eye!

When you live in a town where every drop of fresh water comes from the sea, when you bath, wash up in and drink sea water, this tag may be the local variant of 'Cheers.' But we doubt it because fresh water made by evaporation from sea water carries no hint of its origin; it is purer and fresher than water obtained from most lakes and rivers. Such a town is no pipe dream. Richardsons Westgarth are building and installing *now* flash evaporators large enough—and economical enough—to supply towns with fresh water from the sea.

The difficulties with deposits and salt accumulation which bedevilled earlier types of evaporators have been eliminated. The new R.W. flash evaporators run continuously with practically no attention and operate on steam at sub-atmospheric pressure. As we are manufacturers also of turbo-alternators, water-tube boilers, etc., and builders of complete generating stations we are particularly well able to plan and carry out integrated schemes for the supply of power and fresh water.

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Same Day Service

(Continued from page 108)

of each well is presented, in detail.

In the past, the routine collection of well information has averaged about 80 "titles," or items of information on each well. In comparison, WRS will seek approximately 160 titles on each well. These range from the basic location data to complete core and test details, mud conditions during tests, complete pressure resumes, bit sizes and life, cementing and treatment details, and so on.

Data collected by WRS does not eliminate an individual company's need for day-to-day watching of an important wildcat. Nor does it replace the important land data which the company's own agents acquire. Companies will, it is expected, employ their own people in areas in which their interests are especially active. Thus, personnel of a given company are not working at collection of routine data.

WRS stresses "the life of the well" in its service. A well is followed from the time it is spudded until it is abandoned, or it is followed through its producing history to the point of abandonment as a commercial producer.

At the present level of drilling in the region, WRS will be responsible for maximum data and reports on about 5,000 wells each year in the Rocky Mountain states, spread over a north-south distance of over 1,000 miles.

Within this area, more than six times as many people have in the past been involved in data collection. Information was assembled individually, transcribed by hand, duplicated after a transcription lag, and finally circulated on a round robin basis.

PIC uses the Lahee system of well classification in WRS. Dr. Frederic Lahee kicked off the orientation sessions of the newly formed WRS organization with both formal and informal discussions of the need for consistent classification and the system he had fathered. END.

Sulfur Recovery

(Continued from page 104)

rapidly. Optimum means for its recovery have not been worked out.

An older process, which is also based on liquid phase oxidation of H_2S by means of a bivalent salt employs a solution of sodium carbonates, sodium arsenite and arsenous acid as oxygen-sulfur carrier. This method, known as the "Thylox process," is today practiced in conjunction with sulfur recovery from coke oven gas. It has also potential value for recovery of a premium grade sulfur from sour refinery gas.

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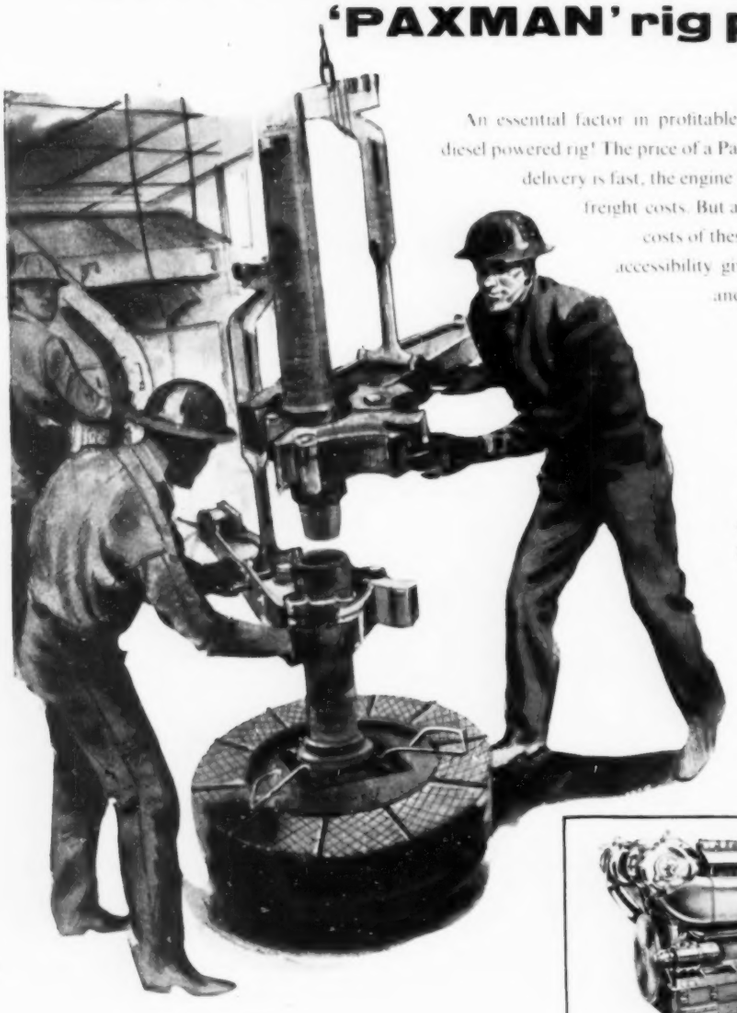
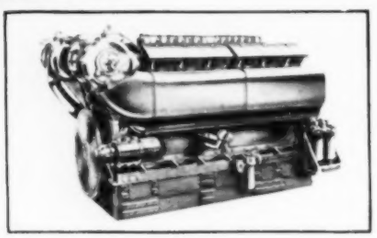
[3] Rieve, R. W., et al. "Improved Process for Sulfur Recovery from Refinery Gases." (Paper presented before Fifth World Petroleum Congress, June 5, 1959).

Down-to-earth facts about 'PAXMAN' rig power



An essential factor in profitable drilling is a Paxman diesel powered rig! The price of a Paxman diesel is right, delivery is fast, the engine is lightweight – cutting freight costs. But above all . . . running costs of these diesels are low, their accessibility gives easy maintenance and they are backed by a world-wide agency network with a *real* after-sales service.

Just check on it – and you will find why so many Paxman diesels are in oilfield service today . . . *and have been for years!*



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New Camdrill Rig for Libya

Big Rig For Libya

A giant mobile drilling rig, the Desert Star No. 2, has just been completed for Camdrill International, Inc., of Los Angeles. The rig was built by Ideco, Inc., to Camdrill specifications. It operates in Libya for Oasis Oil Co.

The huge rig is one of the most completely unitized mobile rigs of its size ever built. Major components are mounted on five semitrailers which will be pulled over the desert by diesel trucks equipped with high flotation-type sand tires. The rig has a 10,000-ft. capacity and can be moved over the desert without roads.

Two 375 horsepower Caterpillar D397 engines will burn crude or low-grade diesel to power the draw works through a two-engine, three-shaft in-line compound. An Emsco D300 slush pump, is driven by another Cat D397 Diesel, and the assembly is mounted on a separate trailer. On another trailer, an Ideco 600 slush pump receives power both from an additional D397 and through a propeller shaft drive from the draw-works compound. The Cat engines are equipped with new type Clark 24-inch converters.

60 channels per bayside . . .

complete with carrier and power supplies

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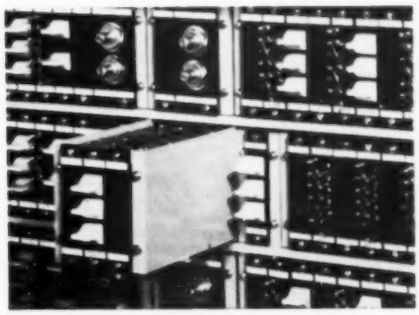
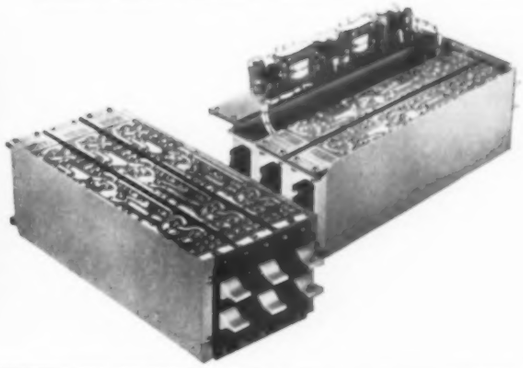
- Uses standard 9 ft. x 20½ in. bays, allowing immediate incorporation into existing station arrangements
- Station cabling terminates at each 6-channel block





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Changes At Loffland Bros.

Loffland Brothers Co., Tulsa, has announced a number of key appointments under a new organizational setup. William J. Weaver, secretary-treasurer, has been appointed manager of administrative services. Thomas W. Wheeler, formerly vice president of contracting, has been promoted to executive vice president of Loffland Brothers domestic companies.

Marshall W. Cone has been appointed general manager and Paul L. Waid superintendent of operations of Loffland Brothers Co. of Canada.

Decker Honored By Nomads

E. L. Decker, founder of the Nomads, was recently honored for his work in founding the society.

Mr. Decker, president of the Martin-Decker Corp., Long Beach, Calif., was presented with a commemorative plaque by the National Board of Regents at the Nomads international party held at the recent International Exposition in Tulsa. The presentation was made by John Pearce, chairman of the National Board of Regents.

New Parsons Co. Appointment

Robert V. Peaslee has been elected vice president of The Ralph M. Parsons Co., Los Angeles. Mr. Peaslee, formerly vice president of C. F. Braun & Co., will be located at Parsons New York office.

Water Test For Jets

A new testing device that can detect traces of free water in jet fuel so minute that they are measured in parts per million of that fuel has been announced by Esso Export Corp. The device, called HYDROKIT, is applied as a "Go-No Go" test at the last crucial stage in the fueling process—when fuel is being delivered into a plane. It demonstrates whether the fuel is sufficiently "dry" to assure safe, efficient operation of the plane's turbine engines.

Borror At Herb J. Hawthorne, Inc.

John W. Borror has been appointed field sales engineer at Herb J. Hawthorne, Inc., Houston, Texas, manufacturer of oil industry exploration drill bits. Borror's experience throughout the Mid-Continent, Texas and Gulf Coast areas will be applied to field engineering problems of the shot hole, core hole and slim hole drilling industries.

Schlumberger Promotion

Frank H. Yeagers has been promoted by Schlumberger Well Surveying Corp. to manager of the Mid-Continent area with headquarters at Tulsa. He succeeds Milton E. Loy who has been transferred to New Orleans as manager of the southeast area. Mr. Yeagers formerly was manager of the Louisiana Gulf Coast division, a position he has held since 1952.

Heads Dresser Marketing

Hector P. Boncher has been appointed vice president-marketing, of Dresser Industries, Inc. He has been an operating vice president since 1955 and has been with Dresser companies since 1929.

CB/S Adds Three To Staff

Cooper-Bessemer Corp. subsidiary has announced the following engineering staff additions to meet the growing demand for gas compressors packaged at its new Houston facility at 1400 Britmoore Road.

Harry L. Jackson, former technical service manager and assistant chief engineer at the union tank division of Butler Manufacturing Co., has joined C-B Southern, Inc., as a development engineer. Richard L. Flowers and George H. Haltom are new members of the CB/S sales engineering staff. Mr. Flowers was formerly division equipment engineer of the Phillips Petroleum Co. and Mr. Haltom was manager of machinery sales for the Houston Oilfield Material Co. for the past 11 years.

ROBT. E. JAMES

Robert E. James, 51, export sales manager for Security Engineering Division, one of the Dresser Industries, died in London, England following an emergency operation. Mr. James, a member of NOMADS and A.I.M.E. Society of Petroleum Engineers, was highly respected for his worldwide knowledge of the drilling industry.

T. E. Casselman, Jr.

Stone & Webster Names Casselman

Theodore E. Casselman, Jr., of Stone & Webster Engineering Corp., has been named manager of the New York office. Stone & Webster designs and builds power plants, petroleum refineries, chemical processing plants, nuclear facilities and other types of industrial facilities in all parts of the world.

Spanish Valve Brochure

A new brochure printed in Spanish on Harrisburg's resilient seal valve is now being offered by Harrisburg, Inc. This brochure contains a complete description of the valve including a breakdown with pictures and description. Specifications, sizes, and a list of parts are also shown. Brochures will be sent on request by writing Harrisburg, Inc., P. O. Box 1053, Houston, Texas.

Allen Heads Solar Chicago

Robert L. Allen has been named president of the Solar Chicago Division of U. S. Industries, Inc. The division, located in Chicago, engineers and manufactures tanks and pressure vessels for the oil, gas, chemical and brewing industries.

CB&I Plant In Holland

Chicago Bridge & Iron Co., Chicago, has announced formation of a company in The Netherlands to erect large steel plate structures fabricated in that country. The company, headquartered in Rotterdam, is Chicago Bridge (Nederland) N. V.

The new organization is a subsidiary of Chicago Bridge Ltd., London, England, which is a subsidiary of Chicago Bridge & Iron Co.

A Reappraisal Needed

(Continued from page 57)

come of all this, it is clear that the producing countries intend to participate more widely and more actively in the decision making processes of the international oil industry: operating within their borders. Moreover, they themselves hope to enter into and contemporaneously to operate in all areas of oil activity: production, transportation, refining and marketing, and to train their young men to be ready to take over the intricate and massive complex of production, refining and transport facilities which these countries will some day inherit. This was the clear message of the First Arab Oil Congress held in Cairo earlier this year, as well as of the recent moves of the Venezuelan government in setting up a national oil company.

All of this confronts the oil companies with the question of what, in the light of all the circumstances, are they to do? This question becomes more urgent when one considers that although the Iraq government did not attend the Cairo Oil Congress, the Iraqis themselves have proposed a plan for a unified Arab oil policy *vis a vis* foreign investments in Arab oil, and have agreed to join in a meeting of the Arab League Committee of Oil Experts which was scheduled to meet in Saudi Arabia on October 17.

Certain it is that concessionaries everywhere and particularly in the Middle East, must take steps to communicate more freely and fully with their respective grantors. Specifically, this means, for example, the oil companies must discuss frankly and fully the matter of prospective changes in the world oil structure, if not, indeed, the very bases of that structure, with their grantor governments. It is simply no longer feasible to announce, as the major oil companies announced just before the Cairo meeting, that the posted prices of all mideast crude oils were cut 18 cents a barrel across the board. This cut meant a loss to the producing countries of apparently nine cents a barrel or a total of approximately $135,000,000 on the basis of 1958 production in the area. Specifically Iraq found itself short $24,000,000 of its anticipated revenue; Iran's budget (just adopted) was short approximately $27,000,000. Kuwait was short $46,000,000, and Saudi Arabia, which presently counts every penny, found itself overnight $35,000,000 short of its expected revenue. Such drastic and unheralded adjustments as this price change made necessary in either the current budgets of the several Arab countries or their revenue projections, are simply no longer acceptable and should be avoided.

The question is not so much whether these cuts were justified by market conditions. Presumably the companies were convinced they were, for otherwise they would, not unnaturally, make every effort to avoid depreciating their oil assets in these countries. But the competition and other factors which led the companies to decide a general price cut was essential, should hereafter, in my view, be put before the proper authorities in the producing countries—not for their approval or veto, but as a matter of common interest.

If it be objected as to the American companies, that the antitrust laws forbid such a procedure, the reply would seem to be that surely those laws never contemplated such a situation. If they did, the statutes should be amended—true, this is easier said than done—but still the proper course if the American oil industry is to operate successfully abroad in competition with other powerful entities not so inhibited. What is essential, if these concessions are to continue to be honored, is that the oil industry in the Middle East and elsewhere seek every legitimate means and avenue to narrow the obviously wide gap in communication that exists between the Arab governments (and presumably all the other grantor governments) and the oil companies and to do it freely and quickly.

The demand of the producing countries for an increasing share of the profits of the world oil business is one that will grow, although it has been slowed for the present at least by the state of the world oil market. Every reasonable effort will have to be made to meet it, so far as possible, though not, I believe, to the extent of accepting the principle of "integration" or "sharing all the way" (i.e., to the pump). There will presumably be other ingenious and varied "concession" contracts worked out, such as those signed in the past year with Argentina.

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UNLIMITED VISIBILITY The unique mast design gives both driller and derrick man unlimited visibility . . . every movement and operation . . . derrick floor—racking platform—crown block . . . is clearly in view.
GREATER FLOOR SPACE The large drilling floor measures 24' from drawworks to pipe ramp and 27' 8" from side to side. There is ample room on the drilling floor to place an independent rotary drive. There are no gin pole legs near the drawworks to obstruct catheading operations. No erection A-frame is used. The two lever lift raising legs become integral load carrying members after erection of the mast.
MAXIMUM SAFETY The Full-View Mast does not go over centre during erection . . . the centre of gravity remains on the pipe rack side of the main leg pedestals . . . no snubbing lines while erecting . . . no winch lines to lower.
Excellent stability and rigidity are inherent safety factors of the Full-View Mast design.
ECONOMICAL TO RIG UP OR MOVE The Full-View Mast is engineered and built to combine operational advantages found in the standard drilling derrick with lower cost of moving and rigging up offered by the drilling mast. Assembly and erection are planned for a minimum in labour and equipment.
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local refining facilities rest on more tenuous ground, particularly as most every country, and especially those that lack oil, insist on the erection of local refineries to save foreign exchange and to bolster their "nationalist aspirations." As for petrochemicals and liquid gases, these await only financing and an adequate market without which they cannot, and should not, be expected to succeed. Certain it is that there will be major developments along these lines in the next few years. END

Degree Day Forecasting

(*Continued from page* 110)

of this presents a very grim and discouraging picture to a constantly expanding fuel oil industry, since with increased business the problem only becomes more serious.

Quite a number of years ago, during the latter 1940's, the fuel oil industry suffered a severe shortage due to continued cold weather. This author, then senior meteorologist in the weather office, Pan American World Airways in New York, set to work in specialized research to find an improved prediction of the highly irregular seasonal fluctuations. The research goal was a six-month total degree/day prediction giving better results than the Normal.

Most meteorological forecast procedures include a study of the circulatory upper wind system surrounding the earth, which plays such an important role in dictating the immediate surface weather conditions. Extensive investigation has, however, ultimately proved the vast river of wind was an inadequate forecasting tool beyond the immediate future, and that other more important factors regulated the erratic variations of temperature over longer term periods.

After a three year study, an entirely new approach was discovered early in 1950, which proved promising in producing notably good results. Combined with a unique method of chart work, touching on characteristics of high dimensional phenomena, the technique not only is a good basis for prognosis but has unusual correlation qualities and lends itself well to defining difficult meteorological conditions.

Today, the following suggested types of weather forecasts are available for any city:

(1) Forecasts, delivered as early as July 15, showing the expected degree/day totals for the ensuing quarters, October-December and January-March.

(2) Forecasts, on July 15, showing expected total liquid precipitation for the ensuing October-December and January-March quarters.

With the above forecast information, the weather may be classified for planning purposes under four broad categories:

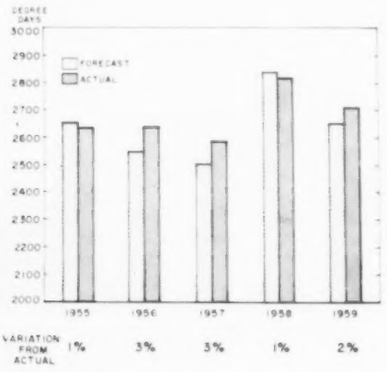

Fig. 3—Forecast results for Brosché Method, for January-March, at New York City, Battery Place, from 1955 to 1959.

(1) COLD/WET—Temperature normal or below, with excess precipitation.

(2) COLD/DRY—Temperature normal or below, with deficient precipitation.

(3) WARM/WET—Temperature above normal, with excess precipitation.

(4) WARM/DRY—Temperature above normal, with deficient precipitation.

These classifications will show the desirable and undesirable features for a fuel oil operation such as high and low consumption, heavy snow potential, floods, icing, and the like—all of which can influence markedly sales, distribution, supply, earnings, etc.

Figure 2 illustrates degree/day forecast accuracy compared to the Normal for nine consecutive years at Chicago for the October-March period. Salient points of interest:

(1) The total nine-year cumulative error (adding annual errors without regard to algebraic signs) for the Normal was a very high 2,604 degree/days, against the "Brosché Method" forecasts with only a single December revision experiencing 1,311 degree/days error. The study shows the Method has 50% less total error.

(2) Maximum variation from actual for

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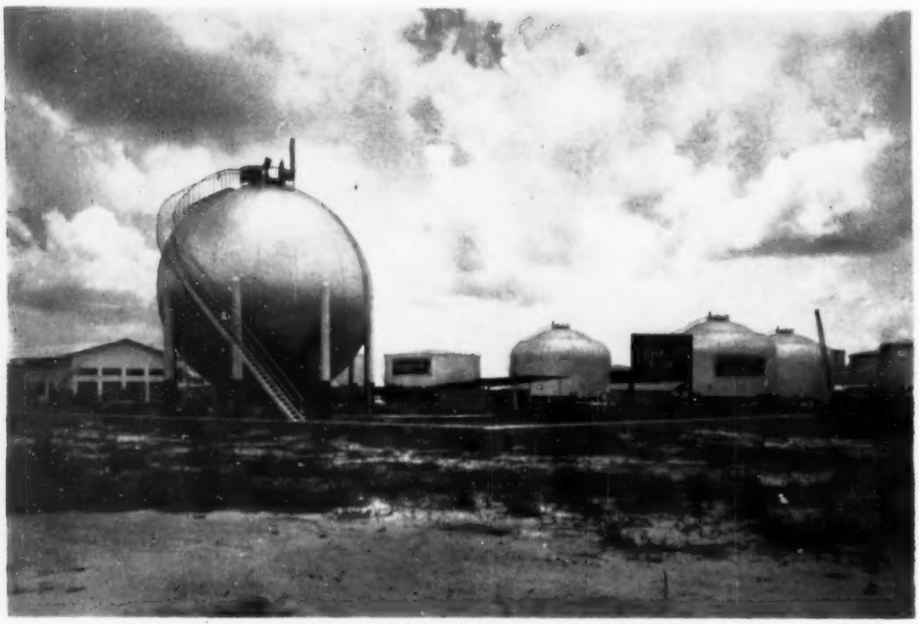

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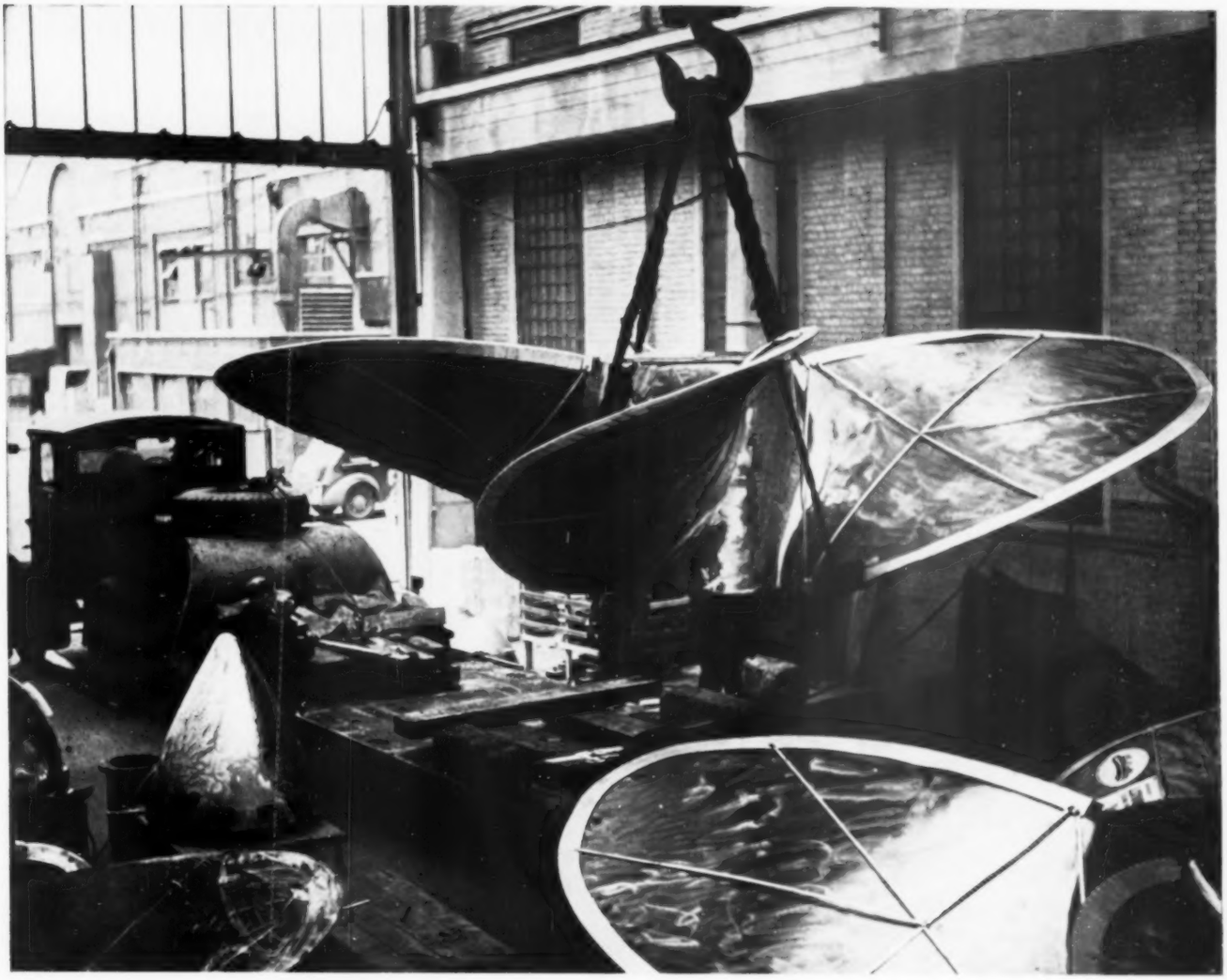

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the Normal was 16%, or a large 752 degree/day error, while the Method's highest error was only 6%.

Perhaps the greatest anxiety in the life of a fuel oil man is to keep just the right amount of fuel oil, in the right place, and at the right time, during the "stretch" period, January through March. It is within this period that usually more than half of the degree/days for the entire year accumulate. More often than not, the fuel oil company will experience one of two very unwelcome conditions if Normals are used: (a) if the winter is very cold, the firm is likely to run short of oil and will have to look elsewhere for a supply to keep the customers warm—at a time when premium prices are likely to prevail, or (b) should the winter be on the warm side, the company will in most cases end the season with an oversupply and will wish to unload —at a time when prices are soft, rather than be subjected to high inventory throughout the ensuing summer.

Both conditions spell trouble for the wholesaler as well as the retailer from an operating standpoint, and the net result in either case is very costly. This cost during a cold winter unfortunately is not only measured in dollars spent in the effort to maintain supply, but more importantly in loss of prestige or customers.

The "Brosché Method" has accumulated a five-year study of January-March predictions issued the preceding July for New York City. Figure 3 shows:

(1) The forecasts followed the trend unusually well, even through the very cold 1958 winter when a complete trend reversal took place after three years of warming. The return to warmer again in 1959 was also correctly predicted.

(2) Maximum variation from the actual observed total was only 3%.

Conclusion: It is reasonable to assume that an accurate forecast delivered as little as three months in advance would be beneficials over the use of Normals. The certified forecast results over many years, and issued nine months ahead, might be used as a suggested means of justifying at least a research basis for practical application.

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Front row from left: Margaret Long, 2nd v. pres.; Gladys Watford, pres.; Bettie Conley, 1st v. pres. Back row, from left: Evelyn Dunham, sec'y, and Mary Garrett, treasurer.

ADDC Officers for 1960

ADDC members chose Miss Gladys Watford of Houston, Texas, as president for the year 1960. Miss Watford is secretary to Ralph A. Johnston, an independent oil man of Houston. Miss Watford's board will consist of Bettie Conley, Estate of Wm. Helis, New Orleans, first vice president; Margaret Long, Imperial Oil Ltd., Calgary, Alta., Canada, 2nd vice president; Evelyn Dunham, J. M. Huber Corp., Borger, secretary; and Mary Garrett, Wm. A. Atkinson, Independent, Oklahoma City, treasurer. Directors chosen to represent the eight regions of ADDC are: Phyllis W. Townsend, Bethesda, Maryland; Emily Fairbanks, Amarillo, Texas; Gladys R. Adams, Shreveport; Gloria Caravantes, Corpus Christi; Doris Southall, Amarillo; Vivian Stephens, Maysville, Oklahoma; Sara Winters, Denver, Colorado; Luella Ulrich, Seattle, Washington; Ellen Vaughan, Shreveport, Louisiana, immediate past president, will complete the 1960 Association Board of Directors. The Desk and Derrick Clubs are educational organizations made up of 117 individual clubs covering the United States and Canada with a combined membership of approximately 9,000.

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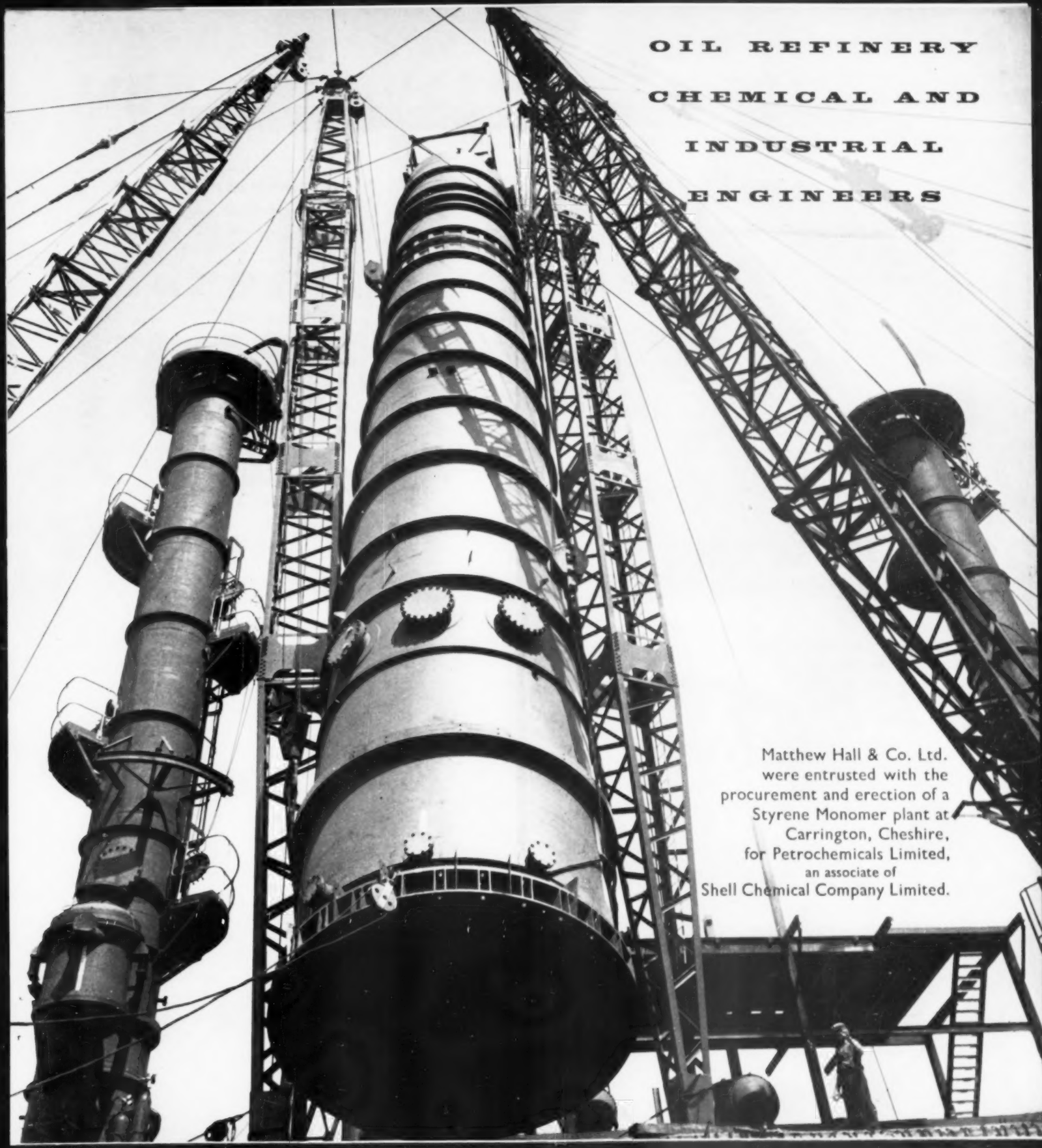
Wins ACS Award

Dr. Melvin DeGroote, vice president of Tretolite Co., division of Petrolite Corp., has been given the 1959 Midwest Award of the American Chemical Society's St. Louis Section.



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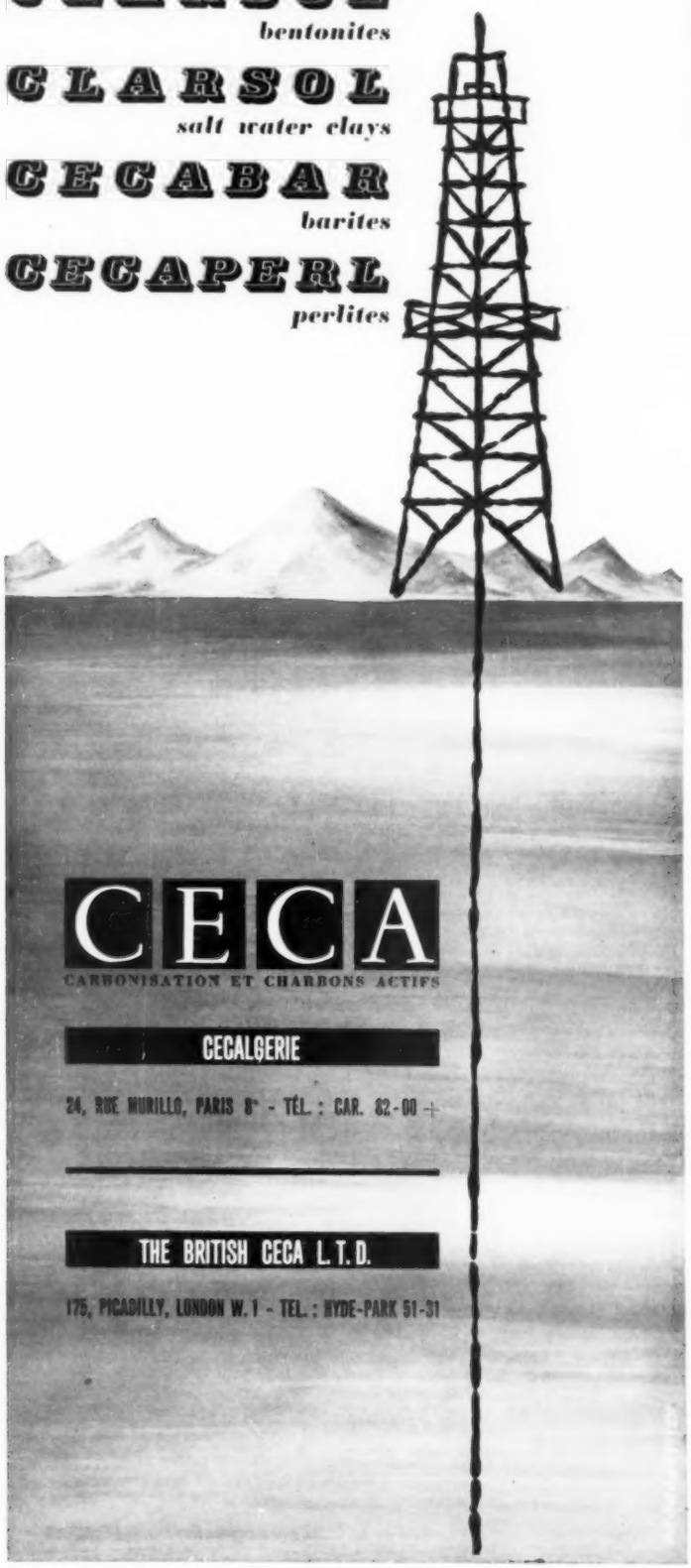

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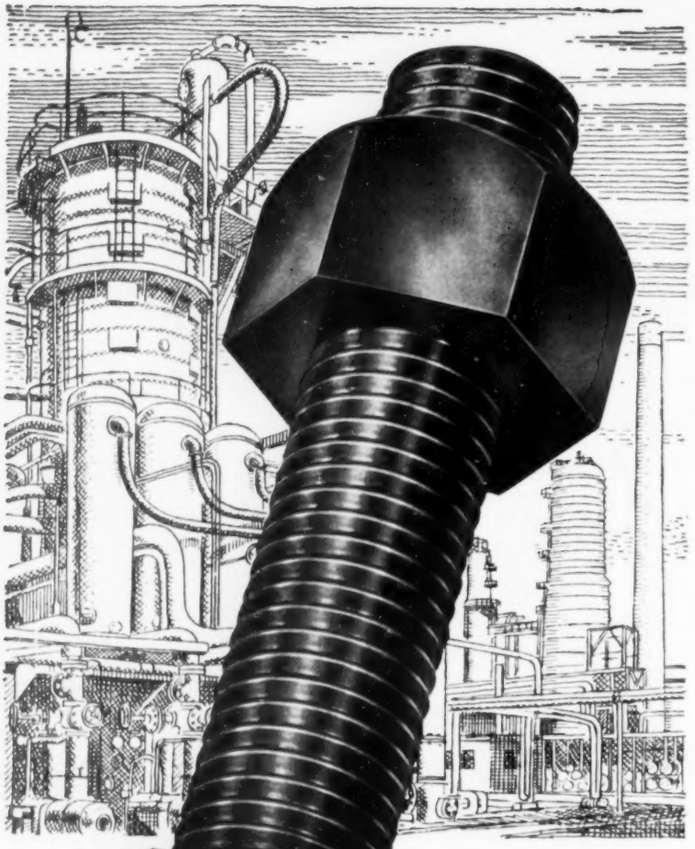

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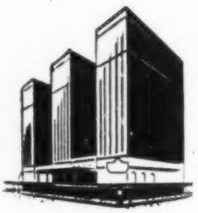

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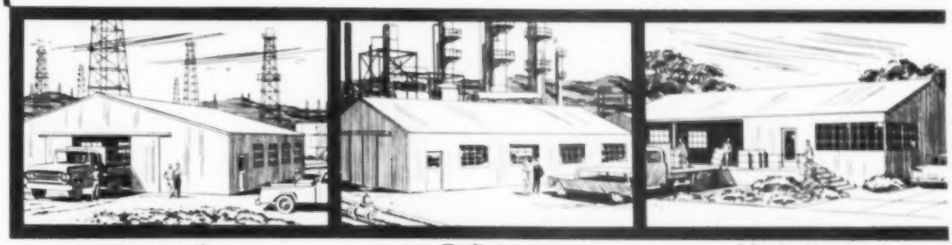

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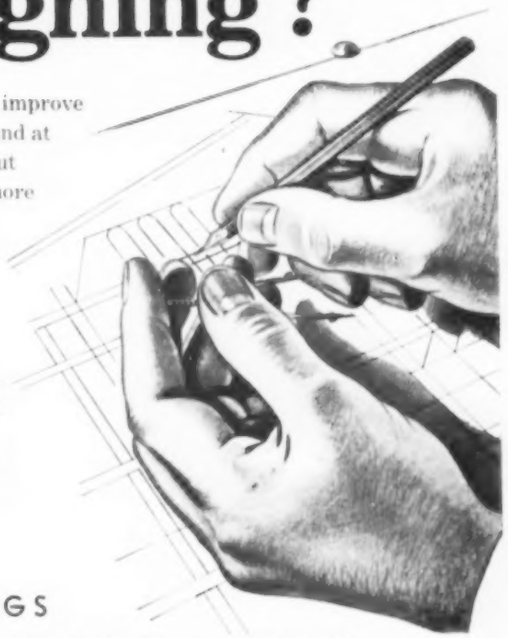

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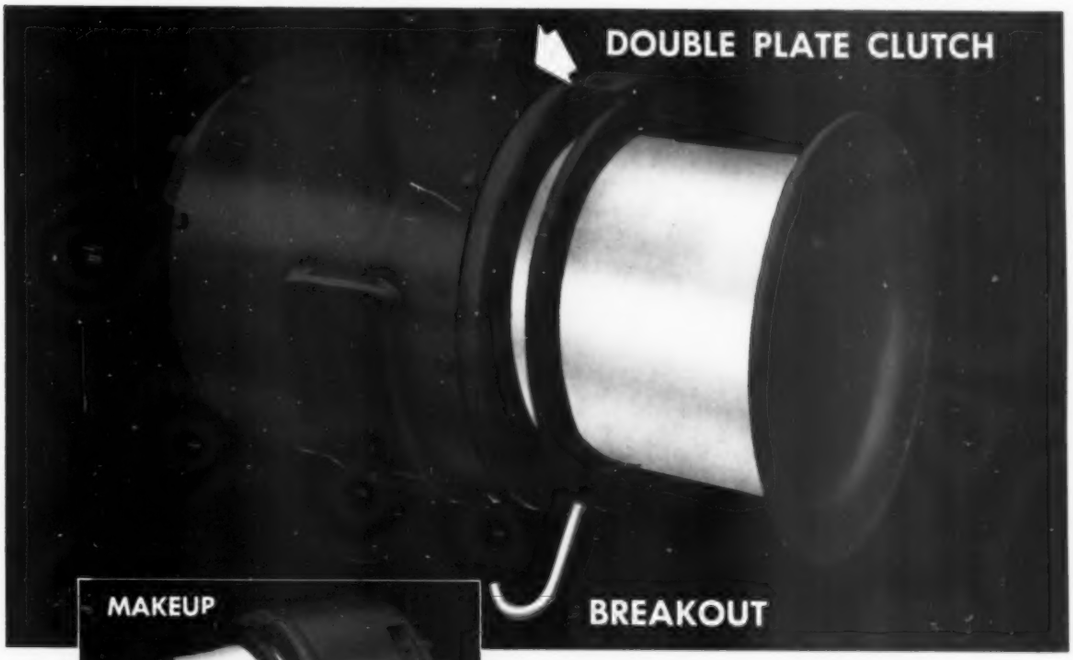

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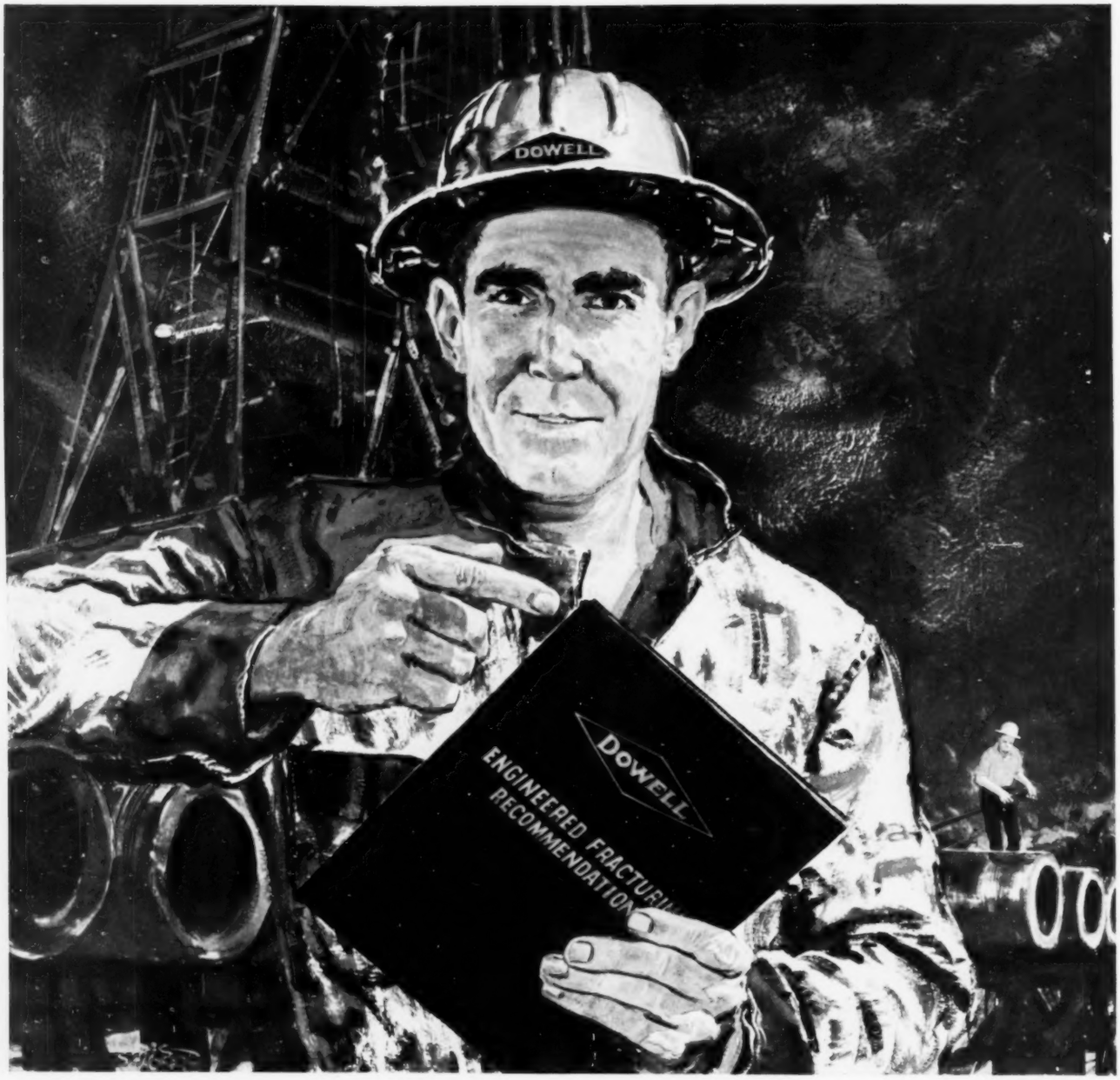

DOWELL CAN PRESCRIBE the *best* treatment for your well. Here's why: Dowell originated *inhibited acidizing* for oil wells some 27 years ago and has improved the techniques continuously. Dowell developed *fracturing* from its original concept to a scientific stimulation service. Through these efforts you now have a wide choice of acid-base, water-base and oil-base services. The latest Dowell development to help you get better production is the "Frac Guide." Of all service companies in the field today—Dowell has the longest experience in well stimulation, the widest background in oilfield chemistry, the greatest variety of acidizing and fracturing services. The ability to apply the proper service to your problem is one more reason why Dowell gives you the most value per treatment dollar. Dowell, Tulsa 1, Oklahoma.

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